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Simple and effective method of intrenching telephone cables in order to protect them against the anchors of small boats and the hooks of fishermen

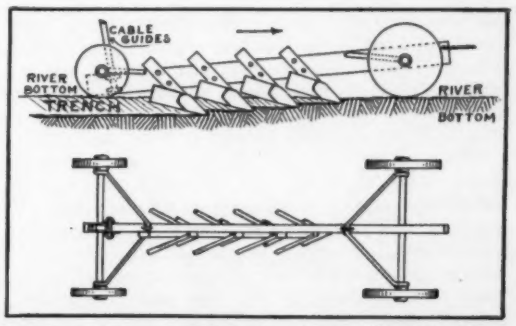
Intrenching Telephone Cable to Protect it Against Hooks and Anchors

TO the uninitiated the sight of a small motor boat pursued by twin periscopes in the otherwise peaceful waters of Jamaica Bay, Great South Bay, or any of the other numerous waterways that surround the Long Island coast, is bound to give rise to serious apprehensions. Truly, the scene is sufficiently bellicose at a time when so much is said and written about prowling U-boats.

But if one possesses sufficient intrepidity to investigate the matter, it soon develops that the twin periscopes are only iron pipes attached to a curious submarine plow; and somewhere along the shore an improvised gasoline winch is chugging away, winding up a rope which connects with the plow working on the submarine landscape. Indeed, far from being engaged in work of destruction, the quasi-periscopes are serving in intrenching telephone cables in order to protect them against the anchors of small boats, the spears of eel fishermen, and the rakes of clam or oyster diggers.

The submarine plow in this case has been developed and built by Supervising Foreman F. Persson of the local telephone company. As shown in the accompanying illustrations, it consists of a four-wheeled vehicle carrying four plow-shares. It is drawn over the submerged landscape by an improvised gasoline winch the power plant of which has seen service on an inexpensive motor car in former days. The plow cuts a trench 14 inches deep in the soft mud bottom, and buries the cable which is guided into place by the twin iron pipes in the manner shown in the larger drawing.

A plow for burying cables across salt marshes, where the resistance of the soil readily lends itself to such a mechanical device, has also been developed and built by Mr. Persson. This trench plow opens a trench 4 inches wide and 16 inches deep at the rate of 40 feet per minute, when pulled by the improvised winch. The plow-share in this case is curved in such a way that it throws up a layer of sod which merely has to be pulled back into the trench with a rake after the cable has been laid. The line of the trench is then monumented with concrete posts where the submarine cable is spliced to the lead cable and with creosoted wood stakes at about 100-foot intervals across the marshy islands. The plow-share is preceded by two cutters which experience shows have to be staggered; for when the cutters are placed opposite each other too much resistance is encountered.



Details of the submarine plow for making telephone-cable trenches

British Experience with Corrugated Ships

CONSIDERABLE interest has been created in Great Britain in consequence of the recent public statement of Mr. Axel F. Ericsson, chairman of the Ericsson Shipping Company and the Monitor Shipping Corporation, setting up the claim that the corrugated ships recently built by his concern have proved to be extraordinarily successful in every respect.

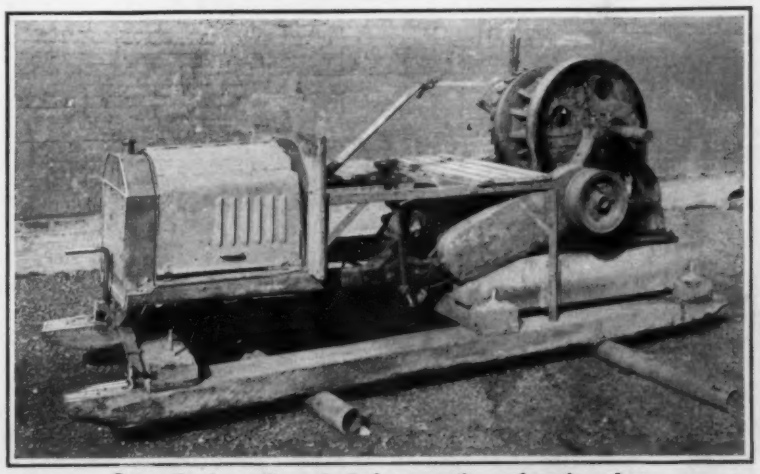
The corrugated-steel ship is produced from patented designs and is distinguished mainly by the fact that the necessary strength is obtained by deep corrugations instead of structural framework.

Mr. Ericsson in his statement said that the Tyne Iron Shipbuilding Company would build many of these ships "simply because they are the strongest, owing to their construction, and the most economical in their working." He continued:

"In my experience during the shipping depression of 1909-1912, when it became necessary for the ordinary ships to be laid up, as they could not make ends meet, the "Monitoria," pioneer of the Monitor system of construction, not only made ends meet, but made a profit during each of the years ending September 30th, 1910, and September 30th, 1911, enabling this company, with only one steamer, to pay dividends of eight per cent each year, and write off substantial amounts for depreciation, etc. The profit earned during these two years was £4,542, toward which the freight on the extra cargo carried over the ordinary plain sister ships amounted to £1,620, with a saving in coal of £452, a total of £2,072. The results obtained under such exceptionally depressed conditions of shipping were so marked that this company built the "Hyltonia," which was delivered in October, 1911.

"These two steamers during the year ending September 30th, 1912, made a substantial profit, which enabled the company to increase its dividend to 10 per cent, and write off large amounts for depreciation, etc., which practically laid the foundation of its financial success. It was, therefore, no wonder that other owners, both at home and abroad, got their eyes opened to the advantages of the Monitor type of cargo steamers, with the result that up to the present time 10 steamers have been built with a gross tonnage of 19,619, and a dead-weight carrying capacity of 34,238 tons. If these steamers had been of the ordinary flat-sided type the dead-weight would have been 32,930 tons, so that the extra carrying capacity represents an increase of four per cent. In spite of the increased carrying, there is also a reduction in the consumption of bunker coal of about fifteen per cent, the speed being the same in both cases.

"In my opinion, in bringing the building of Monitor corrugated ships to your yard and to the Tyne we have brought to the shipbuilders of this river one of the most important economic developments in the construction of ships that has ever taken place, and it comes at at time when it is of national importance to increase the carringy capacity of the mercantile fleet, and also insure the utmost economy of fuel. The Monitor corrugated ships do both, and I am sure posterity will do justice to all who have taken a hand in so important a development."



Improvised gasoline winch for operating submarine plow

Deaths by Suffocation

NOTWITHSTANDING all warnings against running a gasoline motor in a closed garage many deaths by suffocation are reported every year when cold weather comes on, and they are usually of people who are supposed to be reasonably intelligent. For the benefit of automobile users we will repeat the warning not to run an internal combustion motor in a closed garage under any circumstances. Contrary to the general impressions the gas that produces such sudden and fatal result, has no odor whatever, and a surprisingly small percentage of the gas is fatal. Moreover, in most cases, the gas gives absolutely no warning of its presence and the victim has no chance, the first sign of its presence being a sudden, total and helpless collapse.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Shipping Situation

IN his summary last week of the first year of Germany's unrestricted submarine warfare, Sir Eric Geddes, First Lord of the Admiralty, said: "The submarine destruction still exceeds the production of ships, and in the meantime the demands for tonnage are increasing by leaps and bounds. . . . When we first asked the United States for ships there was a quick response. In no way can the United States help more than in building ships. Is she succeeding? Is she throwing her best brains and energies into it? I hope she is."

Is she? She is and she is not.

Congress has done its part by loyally granting every dollar of the vast sums which have been requested. Capital has done its part by the construction of enormous shipbuilding plants and by the enlargement of those which existed. The great industrial plants of the country have done their part by bending every effort to produce the huge quantity of materials needed for the construction of the ships. The press of the country has done its part by explaining the serious character of the shipping problem and urging upon the country the need for pushing it through with all possible expedition.

Nevertheless, in spite of this widespread combination of National effort, the shipbuilding scheme is threatened with failure because the most important factor of its success—the hearty, whole-souled and patriotic coöperation of labor—has failed to materialize.

As matters now stand, the Government has the organization, it has the materials, and it has the shipbuilding plan, but it cannot get the labor. Not only so, but *labor has used the present national emergency for its own particular profit—in proof of which we point to the fact that during a period of six months, there have occurred over thirty-five hundred strikes in the shipbuilding industry and in those industries which are contributory thereto.*

Now the SCIENTIFIC AMERICAN gives place to no one in its desire to see labor receive an adequate reward for its work; and we believe that in this era of high cost of living it is only just that there should be a generous increase in the scale of wages paid. On the other hand, we cannot but feel that, in view of the fact that wages have been doubled and in some cases trebled, over what they were in peace times, the holding up of the work of this great national war program to the extent of over thirty-five hundred strikes within a period of six months, exposes labor to that very charge of "profiteering," of which we hear so much in the present hour.

The Shipping Board has sent out a call for 250,000 skilled mechanics for work in the shipyards. It offers them a scale of wage that is extremely liberal. If the labor unions and those other powerful influences which control labor wish to do so, they can send these men to the shipyards as fast as the Government can use them. *If labor fails to respond to the call, there is but one alternative—conscription.*

Now, let us look at the salient facts of the shipping situation as it stands today.

In the year 1916, the United States launched 600,000 tons of shipping, and we built 1,400,000 tons of shipping in 1917. The total labor force in our shipyards amounted, in 1917, to 75,000 men.

The plans of the Shipping Board call for the construction of 6,000,000 tons of shipping in 1918, and if we succeed in building this tonnage we shall be able to place our armies in France, supply them, and also carry to our Allies the food, fuel, and other supplies which they must have. In putting through this program, we have built 74 new shipyards, and these, with those already in existence, will represent a total of 132 shipyards. In these yards there are 302 ways for the construction of wooden ships and 316 for steel ships, and in our Navy Yards there are 72 ways. Also, we are building, or shall shortly have in operation, three new mills for the rolling of ship plates.

Because of the endless labor troubles referred to above, two months or more of valuable time have been absolutely lost; and it is now doubtful that we can launch the estimated total of 6,000,000 tons in 1918. The present estimate of accomplishment, and even this is absolutely dependent upon the question as to whether labor during this year is to be swayed by profiteering or patriotism, is a total of 4,550,000 tons, made up of 3,700,000 tons of steel ships and 850,000 tons of wooden ships. These figures are based on the expectation that the full quota of men will be secured, working one shift of 10 hours. If the yards were worked with three shifts of eight hours each, a much larger output could be secured.

At the present time, about eight thousand men are employed on wooden ship construction and103,000 on the construction of steel ships. Within the next few weeks, however, as the new shipbuilding ways are completed and the Navy Yard building ways, due to the completion of naval ships, become increasingly available for the merchant ship construction, there will be a rapidly increasing call for skilled workers. It is estimated by the Shipping Board that not less than two hundred and fifty thousand workers will be required, and in order to be prepared to supply this great demand, Mr. Hurley, Chairman of the Shipping Board, proposes to create an industrial reserve army, enlisted for the purpose and held in readiness at the various industrial works throughout the country. The enlistment will be made at once, and the men will be given a badge. A canvass will be made of such industrial plants as employ the class of skilled workers which are suitable for shipbuilding work. And it is hoped that there will be a patriotic response, and that both employer and employee will coöperate in furnishing that quota of men which can be spared from each factory without absolutely crippling the particular industry concerned.

Now here is a clarion call to labor to do its share in winning the war and making this beloved land of ours safe against the most terrible blow that was ever struck against its independence and security. We believe that the failure of labor to rise to the crisis has been due more to thoughtlessness than to lack of true patriotism.

The call has gone forth. The Nation listens. What will be labor's response?

The Sanitary Engineer

"PUBLIC health is purchasable. Within natural limitations every community can determine its own death rate."

We have before us a communication which comes to us upon the letterhead of the New York State Department of Health. In addition to the usual things which adorn such a bit of stationery, this letterhead bears, in a prominent place, the above terse and telling epigram. We were so struck with this very direct presentation of one of the fundamental features in present day civilization that we are impelled to stay with the subject for a little while. For the remark which we have quoted is not merely true, but is significant as well; and it is its peculiar significance that we wish to point out.

To the patient scientific investigator—in this case the doctor—goes, of course, the credit for having made possible the state of affairs which we are discussing. He it is who, with painstaking care and often at the gravest personal risk, has pursued plagues and fevers and tubercular scourges down to their ultimate causes and isolated those causes. He it is who has made the brilliant generalizations concerning bacilli and serums and antitoxins upon which the work of prevention is based. He it is who has been able to bring forward specific suggestions for such indirect schemes of defense as the stamping out of the rat and the mosquito which harbor the actual carriers of diseases, or the treatment to which infected matter must be subjected to make it safe. And in many other ways which we can not enumerate he has fulfilled the normal function of the pure scientist.

But in no field of practice does the effort of the pure scientist suffice. Necessary that effort always is; sufficient, never. The pure scientist can only lay the foundation of knowledge upon which the man who comes after him shall work. And that man, the man who carries out the suggestions of the scientist, who reduces the laboratory method of the research worker to practice, who answers the question: "Now that we know what to do, how shall we best do it?"—that man, in this domain as well as any other, is the engineer.

For we live in the age of the engineer. He may be defined as the man who does things, as against the man who merely knows things. The ancient Greek lived in a misty world of pure science. The very suggestion that knowledge should be used as a basis of achievement was to him sacrilege, reducing something high and holy to the level of a commonplace. But the whole spirit of the modern world looks toward the application of every scrap of knowledge which we can collect, in every field where opportunity for its application can by any possibility be found. This spirit it is that has made the engineer and given him his place of paramount importance in our life today.

In the field of public health as in all others we find him. He must take charge of the production of serum on a sufficiently large scale to inoculate by the million. He must show how the records of public health—of births and deaths and disease—shall be kept in order that they may reveal their full quota of information. He alone is competent to undertake the work of draining Panama or ridding New Jersey of mosquitoes or keeping the Chinese rat out of San Francisco. He it is who must install filtration plants, and design machinery for pasteurization, and develop an adequate system of food inspection. Only he can undertake the supervision of factory construction and operation in the interest of the workers' health. In every branch of the manifold undertaking of keeping the community clean and healthy against its own inertia and frequently against its will, while it is the doctor who suggests what to do, it must be the engineer who finds the way to do, and puts that way into execution.

Following the example of at least one of our great universities which has for some years been training men specifically for this sort of thing, we may call the guardian of our collective health the sanitary engineer. A doctor of course he must be—just as the more ordinary variety of engineer must be physicist, chemist, geologist, mathematician; but just as the successful chemical engineer must be far more than a chemist, so the sanitary engineer must be far more than a doctor. It is to the chemist with engineering ability and training and experience that we take our dye and munitions problems; it is to the doctor with engineering ability and training and experience that we intrust our public health. And if we but give him sufficient authority and sufficient funds and sufficient backing in every way, he will make good on that trust.

Public health is indeed purchasable. The purchasing agent is the sanitary engineer. He has come to stay; more power to him.

Geddes and Persius on the U-Boat

GERMANY and her enemies may be as far apart as ever on most subjects, but on at least one point they are rapidly approaching agreement. The latest statements by Sir Eric Geddes, First Lord of the Admiralty, and Captain Persius, the German naval critic, when stripped of all extraneous frills, simmer down to practically identical terms. Both represent the U-boat as very definitely "held," to quote Sir Eric in his use of the word so often applied by the British in this connection. Perhaps it will not then be amiss for us to inquire just what this word means.

Unrestricted U-boat warfare was launched a year ago with the blunt statement that England would be brought to her knees through starvation within six months. Captain Persius now takes pains to repudiate this idea with the words, "from official quarters it has repeatedly been affirmed that starvation of England is not to be thought of." The plan of the submarine campaign, as he now sees it, is merely so to reduce the enemy shipping that the war against Germany can no longer be carried on with hope of "complete success."

In any event, the U-boat warfare represents a distinct offensive. Like any other offensive, it must gain its objectives to be completely successful; and the most that can be asked of the defense is that realization of those objectives be denied. It is not reasonable to ask that the offensive be wiped out altogether before we will concede that the defensive has made headway. The enemy will, of course, throw fog upon the matter by revising his announced "objectives" from day to day to accord with the facts as they develop. But the very least that he could have expected from a measure which brought the United States into the coalition against him was that that measure would lead directly to a decision in his favor before the United States could become a decisive factor against him. And when Sir Eric speaks of the menace as "held" he merely means to imply that this expectation is completely defeated. The U-boat will continue to sail the seas and to sink merchant vessels until peace comes. But that it is, or barring some unforeseen development that it will become, decisive, he distinctly brands as out of the question; and Captain Persius comes perilously close to admitting this.

It is our business to develop our present procedures to the utmost and to guard against the unforeseen development. Sir Eric is well pleased with the direct work of attack and defense at sea. He says the U-boat gets fewer chances and is able to score a smaller percentage of successes in those it does get. He asserts that in our destruction of the U-boats we are keeping ahead of the German builders. We are not yet building ships as fast as we are losing them; but we are led to hope that we shall soon be doing so. The sinkings continue to decrease gradually; and Sir Eric scoffs at the suggestion that this is due to fewer sailings. He extracts great comfort from the fact that what he now introduces as the "factor of exaggeration" curve is steadily mounting—that the discrepancy between losses actually sustained and those which the German Admiralty finds it necessary to claim is wider every month. Finally he repudiates the idea that the present favorable showing is due to the (hypothetical) mobilization of the U-boats along the route of the United States transports. All in all, it is a most encouraging picture that he paints.

Electricity

Wireless and the Halifax Disaster.—The advantage of having wireless at hand in times of stress was demonstrated when the disaster at Halifax, N. S., in which thousands of lives were lost, occurred. With the land line wires out of commission and the stricken city cut off from communication with the outside world, wireless still remained as a means of getting word to and from the scene of the catastrophe, according to *The Wireless Age*. It was used effectively, too, when a relief train was started from Boston and the War Department was asked to inform the Mayor of Halifax by radio that aid for the sufferers was on the way.

How Thick Should a Telephone Receiver Diaphragm Be?—A recent report of the Research Division of the Electrical Engineering Department, Massachusetts Institute of Technology, has to do with the effects of changes in diaphragm on the characteristics of the telephone receiver. The observations indicate that the natural frequency of the telephone receiver is not proportional to the diaphragm thickness for at least one reason, that the thin diaphragms are subject to greater magnetic distortion. The observed sensitiveness reached a maximum for the particular instrument under consideration near the thickness of 0.23 mm. The resonant range diminished as the distance increased.

Preventing Current from Escaping in High Tension Lines.—In transmission lines operating at very high voltages, 60,000 or higher, losses over the insulators and through the atmosphere assume formidable proportions, according to D. D. Ewing, writing recently in the *Electric Railway Journal*. These losses, or rather the cost of mitigating them, form a considerable factor in limiting the voltage. At high altitudes the loss is very serious, owing to the rarefaction of the air, which loses its insulating properties at low pressure. In this article the author presents the results of some studies conducted on an electric railway line in the Middle West. With the comparatively low voltage of 33,000 volts used on the line tested, the leakage losses are not serious, but the results clearly illustrate the principles involved.

Improvements in Sealing Dry Cells.—A recent French patent taken out by G. L. Tarver deals with the sealing of dry batteries, with a view to preventing deterioration and to economizing the active surface. In the ordinary arrangement the cell is sealed by pouring in wax at the top with a thickness of about an inch or so. This has the drawback of masking a certain area of active material, and thus diminishing the output of the cell, we are told by *The Electrician*. Moreover, in hot countries, or in cases where the cell is exposed to somewhat high temperatures, there is a danger of the wax melting, and thus allowing the volatile elements to evaporate. The arrangement which is the subject of this patent, utilizes a zinc cap which is connected to the outer zinc case, thus forming one electrode. A small central aperture is left for the insertion of the carbon, and only a small mount of wax is required to keep this in position and insulate it from the surrounding zinc cap.

Magnets for Recovering Sunken Cargo.—Some time ago a barge loaded with about 420 tons of sand-cast pig iron was lost in the Tennessee River near Paducah, Ky. The iron was strewn along the river botton for a distance of 100 feet or more, free of the barge. The insurance company paid some $10,000 to the shippers of the iron, and in order to recover some of this it began salvage operations. For this purpose a barge carrying a derrick and power hoist was employed, together with a powerful electromagnet. The bottom of the river was explored with the electromagnet and in time over ninety per cent, or approximately four hundred tons, of the iron was recovered. In the meantime the price of the iron had gone up appreciably, with the result that the recovered cargo was sold for $16,000, while the total cost of recovering it, including the purchase of the magnet and other equipment, did not exceed $4,000. Thus the insurance company realized $2,000 profit on the transaction. The magnet used was 43 inches in diameter, and of the waterproof type.

New Method of Making Leyden Jars and Condensers.—Long ago the tinfoil type of Leyden jar and condenser for wireless telegraphy and other purposes passed into oblivion, and in its place settled the copper-plated type. A new method of producing metal-coated glass for such purposes is described in *Glashütte*, which, it appears, is a variation of the Schoop process. According to this method the surface of the glass is heated until it just begins to soften and the surface is then sprayed with finely divided metallic powders. The metallic particles are thus driven into the surface of the glass and a very durable metallic coating ensues. It is stated that when the under surface of the glass flask is treated with copper or aluminum in this way the water can be raised to boiling point in three-quarters of the time that would otherwise be necessary, and, in addition, the vessel is much less liable to crack. One would imagine that this process would have useful applications for treatment of glass reflectors for lighting purposes.

Science

Teaching Sanitation with the Stereopticon.—The United States Public Health Service maintains a stereopticon loan library, established for the purpose of teaching lessons in sanitation and demonstrating the principles of disease-prevention. During the last fiscal year more than 27,000 lantern-slides were in circulation. They were sent to about five hundred and fifty persons in all parts of the country, and shown to audiences aggregating more than one hundred and twenty thousand persons. Lectures to accompany the views have been prepared on certain topics, and others are in preparation. Sets of slides relating to the hygiene of infants, the sanitary production and care of milk, and kindred subjects, have been prepared and lent for use during "Baby Week" celebrations, at farmers' conventions, etc. Some motion-pictures are included in the collection.

The Name of Kamerun.—One of the African colonies recently wrested by Great Britain and France from Germany was called by the latter country "Kamerun." By writers of English speech it has, in recent times, been quite commonly called "Cameroon." Sir Harry Johnston, in a letter to the London *Times* advocates the historically more correct form "the Cameroons," derived from the name given in 1470 by its Portuguese discoverers to the Duala estaury (Rio dos Camarões, "River of Shrimps"). It is to be hoped, however, that Johnston's suggestion will not receive the support of geographers. The Encyclopedia Britannica, in its 10th edition, wisely abandoned what it calls "the older and clumsy name 'the Cameroons'" in favor of the more practical "Cameroon." A plural name for a country is a nuisance—as we who live in "the United States" know from daily experience!

Injection Experiments on Plants.—The earliest experiments in injecting various solutions into plants were those of Erhart and Reichard, who published their results in 1873. A few years ago F. Weber succeeded in influencing the unfolding of winter buds by means of a water injection. A few others have carried out similar experiments. The latest contribution to the subject has recently been reported by Yasutaro Yendo, whose experiments were made at the University of Tokyo. His object was to determine the mode and extent of transport of the injected substance in the plant body, rather than the ultimate effects. Solutions of lithium nitrate, copper sulphate, rosin and aniline violet were injected into various parts and organs of plants belonging to the various branches of the vegetable kingdom. His results show that the rate of transport of an injection varies according to the nature of the injected substance; that the injection is mostly carried to that part where transpiration is going on most rapidly; that there is a relatively slight but perceptible transport of injected lithium in deciduous trees treated during the winter; that upward transport is always conspicuous, downward transport generally less so, and transverse transport very feeble. The speed of transport of an injected solution varies according to its concentration. The solutions are carried mainly through the xylem elements, and also through the phloem parts; other tissues conduct them to some extent.

Scientific Publications from Germany.—Long before the United States entered the war the transmission of German scientific books and journals to libraries in this country was seriously hampered by the activities of the British censorship. Efforts have been made by the librarian of Congress, Dr. Herbert Putnam, to secure the release of the great accumulation of scientific literature which has been held in London, and these efforts have been partially successful. Forms have been prepared for the use of librarians in applying to the British procurator general for the release of publications supposed to be consigned to their respective libraries. These applications must be certified by the librarian of Congress. A large amount of German scientific literature which had been ordered by libraries and individuals from dealers was held for a long time at Rotterdam, but part of this has now been shipped, and the rest will shortly follow. On arriving in New York it will be passed upon by a representative of the Department of Justice and a representative of the Library of Congress. After passing inspection the publications will be forwarded to their destinations. The foregoing statements refer to publications ordered before the United States entered the war. The problem of securing more recent German and Austrian publications is complicated by the Trading With the Enemy Act and other considerations. It is obvious, however, that such literature might in some cases be used to good advantage in our own war work, direct and indirect, and Dr. Putnam thinks publications from the enemy countries might be obtained with the aid and approval of H. M. Stationery Office in London. The State Department is seeking information from the British Government as to how the latter secures needed publications from Germany. For all these facts we are indebted to a statement prepared by Mr. Paul Brockett, librarian of the Smithsonian Institution, at the request of the National Research Council.

Industrial Efficiency

A Fortune in Worn Out Tires.—According to the statistics of a rubber expert the world discarded 183,000 tons of automobile tires during the year 1916. Adding to this the large number of bicycle tires thrown away every year by their owners, it appears that the world spends, every year, at least $600,000,000 for pneumatic tires alone. During the last Automobile Exposition in New York, it was pointed out that nearly 5,000,000 automobiles are now in use in the United States. To supply these with tires, nearly 80,000 tons of India rubber are needed every year and the American automobile owners pay every year as much as $200,000,000 for their tire bill.

The Biggest Employer of Labor.—Our Government today is the biggest employer of labor in the United States. In normal times Uncle Sam employs approximately 400,000 hands in all kinds of civilian positions. Since the outbreak of the war this number has increased to 600,000. The Brooklyn navy yard alone has added 8,000 men to the 6,000 employed there before the war, and the National capital, houses, today, over 30,000 civil employees above the number before the war. With the completion of an ordnance base in France another 15,000 men will be added to the civilian payroll of the government, and the day is not far when more than 700,000 men will be in the direct employment of the United States outside the millions of the army and navy. As a comparison it may be mentioned that the United States Steel Corporation employs 300,000 men and the Pennsylvania Railroad 250,000. The significance of these figures only appears when they are compared with the average number of men employed in an American factory which is only 22.

The High Cost of Discharging Labor.—During the year 1912 a group of factories with 37,274 employees hired 42,571 men with a net increase of 6,697 men at the end of the year, 35,874 men having left during the same period and gone into other employment. It is estimated that in an average big factory employing 2,000 men, approximatively 1,000 renewals will take place every year; that means that of the 7,000,000 men making up the industrial labor force of the United States 3,500,000 change their places at least once every year. It is, of course, not unusual that in industries having a very sensitive seasonal trade, changes take place considerably oftener. The economic loss to the United States industry caused through this unsteadiness in the labor market is enormous. The cost of training a new man in an industry is valued as between $30 and $200, according to the industry and character of the work to be done. Taking even the lowest figure, it appears that our industries are losing more than $100,000,000 every year from that item alone. In addition to that there must be taken into consideration the expenses for hiring and discharging a man which is commonly put at between 1½ to 2½ per cent of the payroll of the man according to industry amounting to $40,000,000 more. Much money doubtless might be saved by eliminating the necessity of discharging labor during slack seasons. In Europe good results have been obtained by using the quiet season in the home market for manufacturing for foreign trade. The changing seasons of the southern hemisphere bring orders to Europe just at the time when business gets slack in the European market.

America's Financial Position Changed by the War.—During the year 1914 the foreign standing indebtedness of the United States was estimated at $6,000,000,000. Not less than $580,000,000 was paid every year by Americans to other countries to correct the adverse trading balance, and it is said that 55 per cent of the bonded indebtedness and 25 per cent of the dividends of American corporations were paid to non-Americans. The most important item consisted in $225,000,000 for dividends and interests, while $170,000,000 was spent by Americans living abroad, and $150,000,000 at least was paid by American immigrants to members of their families remaining in Europe and at least $25,000,000 was collected from American merchants and manufacturers in the form of payments for ocean transportation. Since the outbreak of the war this position has rapidly improved. Americans have returned to this country and have spent their money at home, fewer Americans have traveled and part of the money saved in this way has been used for buying back many of the American securities lost to foreign holders before the war. All in all stocks at a value of at least $1,000,000,000 have returned in this way into American possession. At the same time America has lent great sums to foreign countries. The American financial holdings in South America are now valued at $400,000,000 and a good deal of investing has gone on in Asia and other countries. All these, however, are overshadowed by the enormous operations of the United States Government in expending more than $3,000,000,000 in loans to the Allied Nations. Adding this amount to the earlier loans given and to the value of the securities bought back, it seems that the former indebtedness of the United States to Europe has been practically wiped out by now.

Chinese volunteer under examination

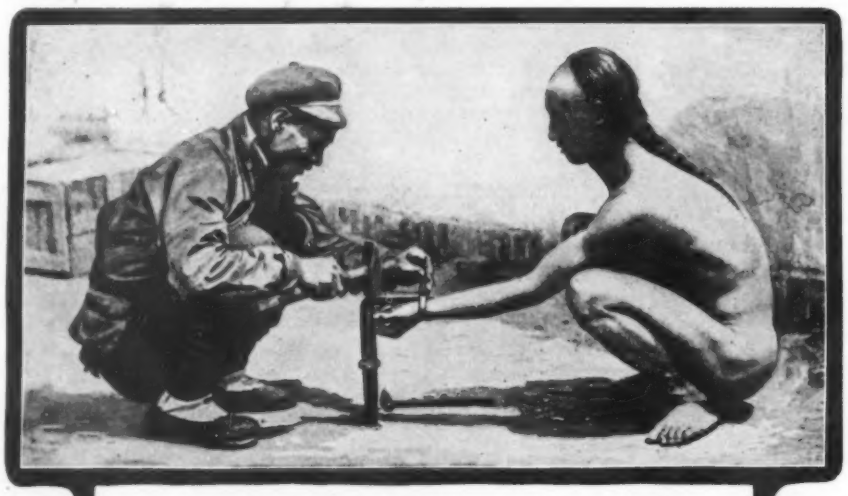
Tapping China's Reservoir of Man Power

Fighters from the Celestial Republic Enrolled in the Battle for Democracy

IT is now some time since China joined the ranks of the powers who are doing what they can to make the world uncomfortable for the German idea of Kultur. It has seemed that the participation of the Celestial republic could mean but little, so far as any effect upon the conduct of actual hostilities is concerned. But while the lack of officers, if nothing else, would obviously prevent the despatch of a Chinese army, as such, to the fighting front, it may not be long before we shall see individual Chinese in the thick of the fray.

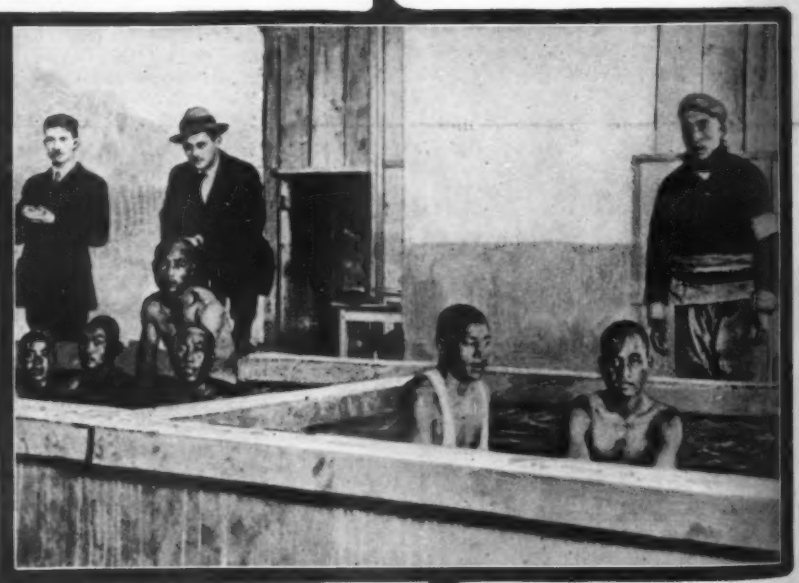
The Allies have decided to tap China's boundless reservoir of man power—not, as has been suggested in some of our western states, for the sake of the cheap labor which has hitherto been the limit of the Chinaman's activities outside the land of his birth, but for actual service in the lines. For their first effort in this direction they have chosen the province of Shantung, home of China's sturdiest workers. With the consent and encouragement alike of the provincial authorities and of the central government of China, the British and French representatives here have called for Chinese volunteers and the call is being answered.

The pictures presented herewith were taken just outside of Tsing Tao, metropolis of the province in question. They show well some of the preliminary steps necessary to qualify the Chinese for a place among the fighters for democracy—steps which, to the subject, must seem passing strange.



Rivetting identification bracelets upon a Chinese volunteer who has "passed"

Cutting the recruit away from tradition and his queue



The novel experience of a bath awaits each man

When an applicant appears, he is first put through a very thorough physical examination by the British or French surgeon. This of itself must be more or less of an event for a man who has probably never before seen a European doctor. But it is not a circumstance to some of the things which follow.

After he has been accepted the Chinese recruit becomes for a moment a human anvil. He is to serve under European officers, to whom all Chinese look alike; it will be necessary, therefore, to have a ready means of identification. So he is given a steel bracelet engraved with his individual number, which is tied up with the other necessary data about him by the official records. To make sure that there shall be no mistake about it, the steel bracelet is neatly rivetted about the owner's wrist; after which he could not lose himself if he wanted to—it would take a blacksmith to lose him.

When he is thus safely tagged, the recruit is given the equivalent of eight cents and sent to the nearest barber shop. Contrary to the usual impression, he is quite willing to have his queue off. Originally a badge of servitude to the Manchu dynasty, the queue for long has meant nothing to the wearer, one way or the other. Now that it has come to mean nothing to his government, the only reasons for not having it off long ago are that his emotions against it are quite as passive as those for it, and that eight cents are far from a matter of indifference to him—the idea of spending all that money for a shave is one that would never enter his head in a million years. When some one else puts up the money, however, he proceeds obediently to the hair-cutter's.

The next thing on the program is a brand new experience—something quite outside the wildest imaginings of any Chinese laborer. He is given a bath! It is the first time anything of the sort ever happened to him, and his emotions are not recorded, though they probably take the form of wondering why in the world any one should go to all this trouble to spill a lot of water over him when the river—filled with garbage and sewage and worse—is so handy.

Once the encrusted filth of a lifetime is separated from him, the new soldier gets a brand new suit of soldier clothes and is handed over to the drill-master. He submits docilely to his period of training, learning readily enough the simple things that are taught him. Finally he is ready to go aboard the transport, with all his belongings in a huge bundle on his back. He doesn't know what it is all about, and nobody takes the trouble to tell him; but once he has found out what is expected of him, he makes a fairly satisfactory soldier—and certainly a numerous one.

Photographs, Copyrighted by Adachi

Chinese volunteers going aboard transport

Fuel Gas for Heating Houses

AS a producer of heat units on the generous scale requisite for such service as house heating, manufactured city gas has not in the past been able to compete with coal, and the householder has had to accept the inconveniences of the latter fuel. There are, of course, other economies than those of fuel-cost gained by the use of gas, and latterly, in Baltimore, it has been demonstrated that fuel-gas house heating is possible by the maintenance of a house-heating service supplying 500 dwellings.

An efficient furnace is a prerequisite to success with gas fuel. Even with gas at 35 cents a thousand cubic feet and coal at $8.50 a ton, the average fuel-cost of heating an entire house with gas will be at least 25 per cent more than with coal, and to keep this difference from being greater it is necessary that the best equipment only be used and proper attention given to its operation. A three-story cottage equipped with a gas-fired steam-heating system consumed, during eight months from October to May last winter, 465,800 cubic feet of gas.

Leaching Copper

A LARGE Michigan copper mine company has recently completed a leaching plant at Lake Linden to recover the copper which has heretofore been lost in the sand discarded from the stamp mills. The plant is a distinct innovation in this field of mining as it is the first successful attempt to recover the copper by a chemical method. The plant began operation on a limited scale in July, 1916, but was not completed to full capacity until February of the following year.

Heretofore the only method of removing the metal from the copper bearing rock has been to crush or grind the rock into a sand and separate the particles of metallic copper by the gravity method of washing and passing over Wilfley tables. It is impossible to remove all the copper in this way and the discarded sand contains approximately sixteen pounds of copper per ton.

In the past 50 years the Lake Linden mills have poured more than forty million tons of this sand, containing 640,000,000 pounds of copper, into the lake. At the present market price the copper contained in this waste sand is valued at not less than $200,000,000. While improved machinery has reduced the amount of copper lost, yet the sand as it is now discarded from the mills contains about ten pounds of copper per ton, which is almost one-third of the original copper contents of the rock, and it is estimated that 80,000 pounds of copper are lost daily by the mills of this one company. Every mill of the district is operating under similar conditions and the total value of the copper lost daily would reach well up into the thousands of dollars.

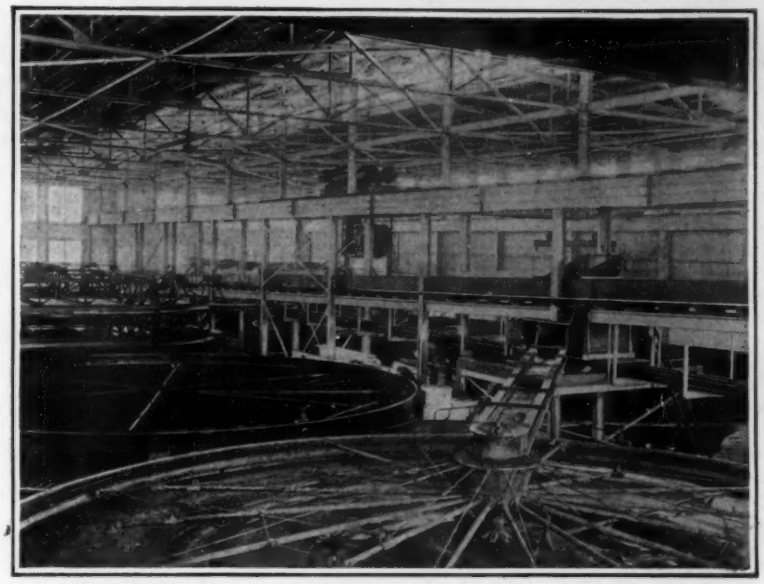
Many different methods for preventing this enormous loss have been tried, but none were successful until the ammonia leaching process was developed. This employs a dilute solution of cupric ammonium carbonate as a solvent for the copper which is in the sands. In the presence of copper the cupric ammonium carbonate changes to cuprous ammonium carbonate and this extracts oxygen from the air and changes back to cupric ammonium carbonate and water. When this cupric ammonium carbonate is heated it breaks up precipitating the copper in the form of the oxide and liberating carbon dioxide and ammonia. The carbon dioxide and ammonia in the presence of steam reunite to form ammonium carbonate which may be used again.

The leaching plant as now in operation, is employed in reworking the sand which has accumulated in the lake. It has a capacity of 2,000 tons of sand per day from which is extracted 20,000 pounds of copper. At this rate it will require 40 years to work over the sand which is now in the lake. Another plant of equal capacity is under construction and will treat the sands as discarded from the mills.

The sand is taken from the lake by a floating dredge, equipped with a centrifugal pump which has a capacity of 1,000 tons of sand and water per hour. The dredge is capable of recovering sand to a depth of 120 feet below the surface of the lake. After the sand is sifted to remove foreign substances it is reground in Hardinge conical mills until it is almost as fine as flour. The free copper is then removed by passing over Wilfley tables before the sand is sent to the leaching plant.

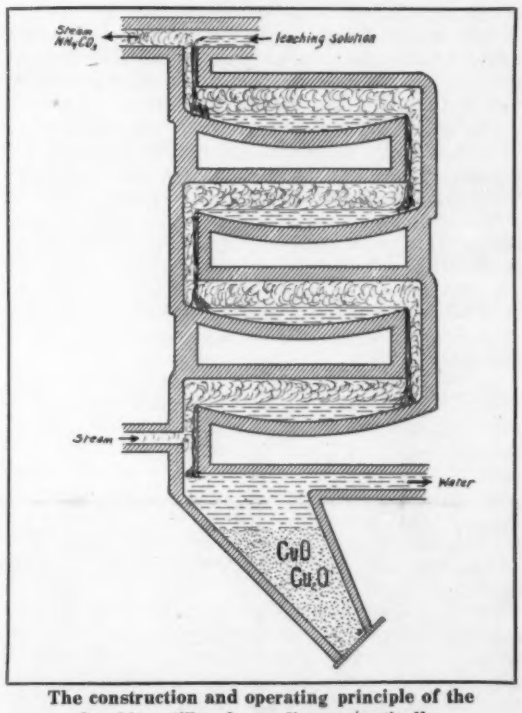
The sand is pumped along with water into large steel tanks where it is treated with the leaching solutions. The present plant contains eight of these tanks each 54 feet in diameter and 12 feet deep, and capable of holding 1,000 tons of sand. In order that the sand may be evenly distributed in the tank, it is run in through a large rotating spray which resembles very much the common lawn sprinkler and operates on the same principle. The water which is pumped into the tank with the sand is carried off by an overflow and the sand settles to the bottom and gradually fills the tank. It requires approximately twelve hours to fill the tank with sand in this way. When filled a cover is placed on the tank and the leaching solution of cupric ammonium carbonate is sprayed on the sand from six radially arranged pipes. The covers are supplied with ventilating holes to provide air for the process. The plant uses the oxygen from 12½ tons of air per day.

The sand in the tank acts as a filter for the solution which is sprayed in at the top. The solution is drawn off slowly from the bottom and it requires about twenty hours for a given particle of the solution to filter through the sand to the bottom of the tank. The sand is first treated with 625 tons of solution called the first leach and with an equal amount of weaker solution called the second leach. This is followed with 200 tons of very dilute solution known as the wash and then the sand is washed with 300 tons of water. About seventy-two hours is required for the 1,750 tons of solutions and water to filter through the sand.



Copper leaching plant. In the foreground is seen the rotary spray and the trough

When the leaching solutions have passed through the sand they are pumped to the still-house where the copper is precipitated. This is accomplished by two sets of stills known as the roughing stills and finishing stills. The stills are constructed as shown in the diagram. The solution enters at the top and flows down from basin to basin where it is all the time in contact with the live steam which is admitted at the bottom. The contact with the steam causes the solution to precipitate cuprous and cupric oxide, and liberate ammonia and carbon-dioxide. The oxides precipitated from the solutions are carried along to the bottom of the still where they are collected in a trap. The liberated ammonia and carbon-dioxide reunite to form ammonium carbonate, passing out with the steam which is condensed and used in the preparation of the leaching solution. About one pound of ammonium carbonate is lost for every ton of sand treated.



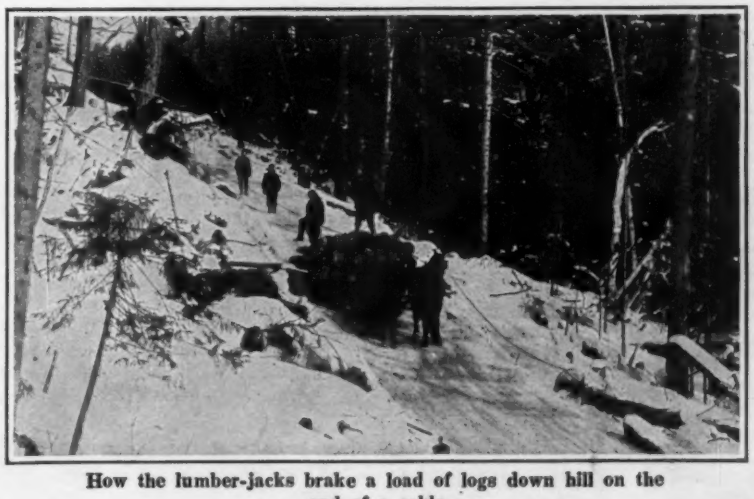
The construction and operating principle of the leaching stills, shown diagrammatically

In passing through the first or roughing stills the solution delivers up 95 per cent of its copper. The remaining five per cent is removed by a similar process in the finishing still and the water which flows from the bottom of the second still is barren of copper, except a small amount of the oxides carried in suspension which is removed in settling tanks.

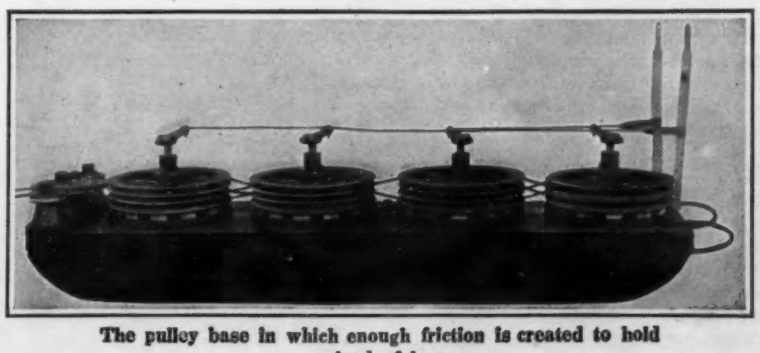
The leaching process recovers approximately seventy-five per cent of the copper contained in the sand at a cost of less than five cents per pound. At the present high price of copper this means a net profit of between 25 and 30 cents per pound on the 20,000 pounds recovered daily. The originator of this process has almost attained the dream of the alchemist, for he has succeeded in transforming a worthless pile of sand into a veritable gold mine.

A Cable Brake for the Lumber Camp

ONE of the great difficulties of the lumber camp is the proper braking of huge loads of logs being hauled down mountain roads which frequently fall but little short of meriting description as preciptious. A fundamental feature of this problem is that even where the customary sleigh is replaced by a wheeled truck, it is not sufficient to keep the wheels from turning, since that leaves open the possibility that the wagon will turn itself into a sledge and go skating down the hillside on locked wheels. So any effective scheme for braking must involve something beyond the ordinary brake shoe.



How the lumber-jacks brake a load of logs down hill on the end of a cable



The pulley base in which enough friction is created to hold a load of logs

The answer to this requirement, as developed by an Adirondacks lumberman, is the external braking device which we show on our cover. The pulley base is firmly fixed at the top of the hill, either by steel cables hitching it to large trees or by means of concrete foundations. The cable that is fastened to the descending truck passes about smooth iron sheaves exerting but little friction; but by slight movements of the lever the operator brings into play one or more of a series of hard maple friction blocks, secured in the bed of the machine. He is thus able to exert at will any desired friction, up to the capacity of his machine; and this capacity, be it said, is quite adequate to hold any load that could safely be put upon the cable itself.

This brake has been in increasing use for four years, and is now to be met in many parts of the United States and Canada, while the Canadian Forestry Battalion has 12 of them in France. Among the many advantages claimed for the cable brake, are elimination of all trouble and expense for sanding or graveling the hills, or spreading hay, etc., to hold back the loads. Moreover, the teams are relieved of all load in going down hill, and hence are in good shape for the trip to the landing. Not only do the teams come out of the woods in the spring in far better shape than under the older regime, but the roads may be built much steeper—and hence much straighter and shorter—than where the work of easing the logs down the slope falls upon the horses.

The Service of the Chemist

A Department Devoted to Progress in the Field of Applied Chemistry

Conducted by H. E. HOWE, Chemical Engineer

Traces—Bad and Good

THE average man who is convinced that the minority never can rule finds it difficult to appreciate to what a marked degree very small amounts—mere traces—of compounds effect things chemical. The old term, "chemically pure," was intended to be applied only to those substances which are really free from all others. Thus "C. P. copper" would indicate that the material was all copper, containing nothing else at all. This designation has fallen into disrepute because it has been abused, and the finer grades of chemicals are now called "analyzed" chemicals because the label states the composition of the material. This enables the chemist to make proper allowances for the impurities, instead of assuming that they are not present and finding later that they were.

Impurities cause much trouble, and some are poisonous to other chemical substances just as some chemicals are poisonous to animals. For example, it was found in working out the Haber process for combining atmospheric hydrogen and nitrogen to produce ammonia, that exceedingly small traces of impurities in the metals composing the catalyst would so poison the mass that a great reduction in the efficiency of the process was caused, if indeed it could be carried on at all. One of the most important chemical problems in working out the process was in eliminating these very small traces of other elements.

Those adverse to the conservation of platinum at this time have said that platinum never wears out in chemical work and therefore the urgency for diverting that metal to research and industry is overestimated. These good people fail to realize that platinum becomes impure in use, and that the platinum sponge masses used in the contact process for the manufacture of sulfuric acid become poisoned and require refining with its attending losses. Resistant as it is to chemical action, traces of some compounds unite with platinum and cause it to become brittle or more readily attacked by some third substance; so it soon requires replacing in order to work at highest efficiency.

In the manufacture of some grades of optical glass, sand with a trace of iron is barred because even minute quantities of iron impart a seriously objectionable color. It was largely the trace of air remaining in evacuated electric light bulbs that caused researches to be instituted upon the behavior of gases in these lamps, with the result that we now have the modern gas-filled lamp with its wonderfully increased efficiency over the old type.

Ninety-nine per cent pure would be considered by many good enough for any purpose, yet many materials of commerce have that purity and can be obtained with relative ease. It is that remaining one per cent that is so hard to put on the right side of the column. Ninety-nine per cent pure bismuth is an article of commerce, but a purer material is required for delicate electrical measuring instruments, and the demand has led to a method's being devised whereby the impurities is reduced to one one-hundredth of one per cent. In this process the nitrate of bismuth is heated until the oxide is formed. Then the oxide is reduced with hydrogen and the residue melted and crystallized.

Ninety-five per cent ethyl or grain alcohol is well known and some measure of the difficulty involved in greater purification is indicated by the difference in the price between the grain and "Absolute Alcohol," which lacks a little of being a hundred per cent.

Still another place where a very little bit of something turns out to be of importance is in the manufacture of luminous paints. In times past there have been many efforts made to devise a paint or a lacquer which would give off light rays in the dark. There are several formulae for phosphorescent paints and other compounds which vary greatly in their efficiency, depending upon the intensity of the light to which they have been subjected and how dark the surroundings are to furnish contrast when in use. Consequently house numbers coated with such paints have usually been a disappointment. More recently radium compounds have come into extensive use and have given much satisfaction, especially on the dials of airoplane instruments, watches, etc.

These luminous paints have found special application in the war, enabling the reading of dials in places where the striking of a match would be fatal. The material used is a mixture of specially prepared zinc sulfide, with a very small amount of radium bromide. The amount of radium salt per gram of zinc sulfide varies from 0.025 to 0.400 milligrams per gram, which is equivalent to four parts in 10,000 at the maximum.

The zinc sulfide seems to have the power of total light emission, and under the conditions present the brilliance of the light continues at all times and irrespective of other light. This power to give off light decreases about fifty per cent in 100 days, but after that the rate of decrease is very much slower.

Paints of suitable illuminosity for many purposes can be made from cheaper materials but in all such cases the period of satisfactory service is much shorter. It is fortunate, indeed, that the coöperation of the Government with other interests made it possible to begin radium production in our country in time to meet the present emergency. And it is also pleasant to be able to chronicle one instance where "the veriest trace" of a given substance is an advantage, rather than a drawback to be removed or overcome.

Where Substitutes Save the Day

WE are gradually becoming accustomed, not only to increased demands for unusual things, but to very insistent demands stamped "please rush." So we are prepared to learn that almost anything in the world is in such demand because of the increased use brought on by the war, that the price has greatly advanced. Nearly always when prices get too high it becomes worth while to search diligently for a suitable substitute.

The catgut which the surgeon uses when he sews is no exception to these remarks. Portions of the intestines of sheep form the usual raw material for catgut. These tissues are put through special processes and are finally cut into long narrow strips which are then twisted into a thread or cord and properly finished, as described in the SCIENTIFIC AMERICAN of February 24th, 1917. The idea was conceived that other animal tissues which are available in quantities might be brought into suitable condition to make catgut, and experiments were begun using beef tendons.

In the light of what has been accomplished those first trials seem crude, and it soon became evident that shredding or other mechanical processes for separating the fibers would yield unsatisfactory results. The next series of experiments undertook to reduce the tendons to a paper-pulp-like mass and from this mass run off a sheet of animal tissue in very much the same manner as paper is made from vegetable fibers. Once in this condition the strips could obviously be cut, twisted, and finished.

To macerate these tendons in such a way that a sheet sufficiently uniform and homogeneous could be produced and still have characteristics to meet all the requirements was a long, tedious undertaking, but it has been successful and catgut made from the twisted narrow strips is an accomplished fact. The problem involved biology, chemistry, and mechanics, and seems to have been very well worth the initial large expenditures required.

The substitute is confined to no one land. In London it has been found feasible and economical to dispense with the use of kerosene in cleaning machinery and to use in its place a hot three per cent sodium caustic solution which does excellent cleansing and still makes it possible to recover the oil and grease. Where possible, parts to be cleaned are immersed in the hot solution and then rinsed in boiling water, after which they dry perfectly and are left clean. The oil is refined by boiling in water and the reclaimed oil is suitable for use in Diesel engines. Oily waste and rags are also treated, many uses being found for both the oil and the reclaimed cloths.

In Holland, too, they have been driven to substitutes in very much the same way that the belligerent countries have. These substitutes include fodder for cattle which is now being made from refuse materials. A factory is soon to open where cattle fodder will be made from fish meal and starch-containing material. Animal tissues not suitable for human food have also been mixed with vegetable refuse and blood and are said to produce an approved cattle feed.

Substitutes are not invariably a result of necessity, however. Sometimes they spring merely from the desire for something different, something new. Among the items making up our high cost of living, the amount spent for wearing apparel is second only to the sum required for our food. Some are not content with mere warmth, and the desire for the novel in adornment keeps more than one research laboratory and experimental equipment busily employed in working out the scientific foundation for new styles.

There is a saying among textile experts that anything having two ends may be spun into a thread, but it has taken time to learn just how to spin feathers so that the down would be held in place during the dyeing and finishing process and not come out while in service. This particular problem now seems to have been solved, and one of the methods for spinning a suitable thread consists in blowing the down upon a center or core thread while the latter is being twisted. The result is that the down is caught up as the thread is being twisted and is held very firmly in place.

This thread is not very handsome in itself, but when woven into cloth and the cloth scoured, dyed, and finished by chemical methods peculiarly suited to the material in hand, the result is a fabric which resembles fur, and which may appear one of these days under an assumed name.

Thus a covering provided by nature for one animal has been made into something resembling that of a second. It is then used to supplement the covering of a third.

"Dry Gas"

THERE are various kinds of natural gas and the term "dry gas" is applied to that which is practically devoid of the higher hydrocarbons which make up gasoline. The waste of natural gas in this country is well known, but in recent years a very large volume of it has been treated for gasoline recovery, including casing-head gas, which comes up in the casings of oil wells and is different from the gas from straight natural gas wells.

There is a very large percentage of dry gas on this continent. It is nearly pure methane and is of satisfactory heating value, but much of it occurs at points where the gas is far in excess of the demand. At the same time, there is a greatly increased demand for gasoline and there have been many important announcements relative to our improvements in making gasoline and to the special treatment of wet gas and petroleum.

Mr. L. B. Cheery announces the completion of an apparatus whereby hydrogen, which may be easily produced or obtained as a by-product from some of our industries, or methane, "dry gas," may be made to combine with the heavy hydrocarbons resulting when petroleum is distilled and by this combination, these hydrocarbons may be converted into gasoline.

An efficiency of 78 per cent has been obtained in experimental stills using kerosene. The electricity used costs but $\frac{4}{10}$ of a cent per gallon of the product and there has been none of the difficulties arising from "cracking."

The device is said to be adaptable to ordinary petroleum stills, the vapors from the still being subjected to the influence of heat simultaneously with a high voltage, high frequency, oscillating current. Under these conditions some of the hydrocarbons are broken down and in the presence of the methane or hydrogen new ones are built up.

Perhaps later experiments may show how to build up members of the benzine series and larger scale experiments are being watched with interest. This may prove an important way of using some of our wastes to produce one of our necessities.

Chemistry in Good Printing

THERE is an establishment in this country that does practically all of its business through its catalogs and, previously, where cloths were concerned, small samples were carefully cut out and attached to the pages, that the prospective customer might see the pattern and form some idea as to the quality through handling the fabric. The labor involved in preparing the samples and the stock required made up an annual expense item of more than $200,000. Research has been employed to overcome this large expense item.

The laboratory began its work to assist the printer in making faithful colored reproductions and to supply information to the copywriter so that value for service could be expressed in terms of measurable factors.

In the printing plant there was to be considered the manner of making the half-tone plates, involving questions from the light filters to the etching fluids. There was, also, the subject of inks in all the variations of those important compounds, and the proper paper to give the desired results had to be chosen with a view to service and durability.

For the copywriter the characteristics of the fabrics were determined and the information reduced to expressions that would convey an accurate idea of value in service to the prospective customer. The work has been successful and the house in question finds it no more difficult, in fact it is easier, to sell goods with good printing than according to the old method.

By good printing we mean printing that accomplishes the desired purpose, and this is an example of good printing which would have been impossible without chemistry.

Mineral Resources from a Military Standpoint

A Measure of Our Potential Fighting Strength

By Joseph E. Pogue, Associate Professor of Geology and Mineralogy, Northwestern University

MODERN warfare demands such vast quantities of materials that an adequate supply of raw material products is as essential to national power as a sufficiency of men and food. The potential fighting strength of a country may be directly measured in terms of population, food production, and mineral wealth; while actual preparedness for war depends upon the extent to which each of these factors is developed by a happy combination of modern industry and science.

In mineral resources, the United States holds a very strong position, both potentially and actually. At the outbreak of the European war she was producing a third of the world's oil, half of its copper, nearly half of its coal and iron, and a third of its lead, zinc, and silver. As a result of the war demand for these and other mineral products, their prices have soared, and for the past three years the mining industry in this country has enjoyed remarkable and unprecedented prosperity. At the present moment, the United States is better prepared as regards minerals than she is in respect to food and men; but unless public opinion be brought to realize the fundamental part played by mineral resources—a part subtle and easily overlooked—we will run the risk of unbalanced development, leaving certain basic matters to be later forced upon us by the hard school of necessity.

It is well recognized that mineral resources, and especially the fundamental ones like coal, iron, and oil, constitute the economic backbone of a country. No nation can become industrially great without control of abundant supplies of minerals. In times of peace, this control may involve a judicious balance between geographic ownership and trade supremacy, foreign countries being relied upon to supply those minerals lacking at home, or present but undeveloped because of unfavorable economic conditions. But in times of war, a new factor enters; foreign trade is hindered and may be entirely stopped. Therefore the *war strength* of a country in minerals depends upon the developed resources present within her borders, and resources lacking or undeveloped may assume a critical meaning out of all proportion to their ordinary economic importance. In preparation for war, accordingly, attention should focus on those resources wanting or neglected by normal conditions, so that the mineral industry may be brought to the highest possible state of independence. To neglect this matter is to repeat the mistake of the allied countries abroad, which were forced to rely on our mineral output until they could shift their own mineral production from an economic to a military footing, a change not yet completed, if indeed entirely possible.

The United States is so rich in obvious mineral resources that there is danger that her weak points will be overlooked. And it is not only necessary that experts should know these weak points, but the public must know them also and appreciate their significance, so that the deficiencies may be remedied, as they can be, by prompt governmental action.

A careful study of the mineral resources of the United States from a military standpoint—and there are accurate data for such a study in the reports of the Geological Survey—reveals the fact that our mineral industry is equal to war demands in all but seven products. These are potash, nitrogen, manganese, nickel, tin, platinum and pyrite—although a stringency is also being felt in regard to mica, graphite and a few other less important minerals.

Potash is of prime importance as an indispensable fertilizing material. Three years ago Germany held a world monopoly of this valuable substance because of deposits of unrivaled richness in Prussian Saxony. But fortunately the United States Government some years prior to the war came to a realization that the potash situation was unsound and through its scientific bureaus instigated a search for domestic sources of supply. As a result of systematic geological exploration and chemical research, accelerated by the acute situation created by the cessation of exports from Germany, the United States is now getting an increasing supply of potash from a varied range of sources, and potash independence is in sight, though still many years distant. We have here a striking object lesson in what may be accomplished through anticipation of a problem and the application of science to its solution. Had the European war come five years earlier, it would have involved us in a potash famine, with a serious reflex in food supply. The United States during 1917 will scarcely produce more than 12 per cent of her normal potash needs.

With nitrogen we have not been so far-sighted. This substance is of even greater military significance than potash, for not only is it required in agriculture, but it is the basis of practically all explosives. Nearly our whole supply for the past half century has come from the deserts of northern Chile, where there are extensive and remarkable beds of sodium nitrate. But the atmosphere is composed mostly of nitrogen, and coal on an average carries one and one-half per cent of this element. It may be obtained abundantly from either, within certain limitations. The atmosphere is the best source in countries poor in coal or with abundant water-power yielding cheap electric energy; coal is the most logical source in countries where there is a large coal production, particularly if at the same time an iron industry requires considerable coke, which is coal freed of its nitrogen and other volatile constituents. In the United States the latter conditions obtain; yet each year we send $20,000,000 to Chile for nitrogen salts, while our coke industry wastes that value of nitrogen and many times that value of other by-products, by making more than half of its coke in the old fashioned bee-hive ovens, flaming anachronisms in the twentieth century.

Realizing our nitrogen dependence upon Chile, the Government in 1916 appropriated $20,000,000 to construct a plant for obtaining atmospheric nitrogen; but more effective would have been parallel action looking at the same time toward a complete recovery of nitrogen in the coke industry, thus making for the elimination of waste and accomplishing more quickly national independence in respect to nitrogen.

Manganese assumes importance because it is absolutely necessary for the manufacture of steel. Before the war we imported 90 per cent of our supply, not because there was a dearth of manganese in this country, but because economic conditions made the development of domestic deposits, which are chiefly low-grade, unpromising financial ventures. The war cut off most of our foreign sources, leaving us largely dependent upon Brazilian ores; as a result the price of manganese multiplied many times and the entire steel industry felt the pinch of manganese poverty. Strange to say, the local deposits have scarcely responded in three years time; and were we suddenly cut off from Brazil, our own industry would be seriously embarrassed if not actually crippled. Thus manganese becomes an important factor in preparedness, and the problem is insistent to speed up the sluggish development of our manganese resources.

For nickel we have depended upon the large deposits of Sudbury, Canada, failing to develop our scattered low-grade deposits. With Canada as our ally, we may still count on abundant nickel. Of tin and platinum, both munition-metals of significance, we have scarcely any supply at all. Unless we can develop new resources in these metals (and the search should be diligent and immediate), we must look to Bolivia for our tin and to Colombia rather than Russia for our platinum, with the possibility that each source may be cut off. Tin is not absolutely essential, but platinum is, and consequently the limited store of this precious metal should be directed to its highest use, and the Government should not wait long on patriotic motives to end its purely ornamental application.

The shipping conditions resulting from the submarine campaign have largely cut off the usual heavy imports of pyrite from Spain, upon which the manufacture of sulfuric acid was chiefly dependent. This has created a serious situation because of the large quantities of sulfuric acid required in the manufacture of explosives, phosphate fertilizer, and in many other chemical industries. The stringency has directed attention to the development of some of the numerous small deposits of pyrite and related sulfides in the East, and suggests the sulfur deposits of Louisiana and Texas as a possible source of raw material, already slightly drawn upon, to tide over the present emergency.

In short, economic conditions have developed our mineral industry to a relatively high state of efficiency, so that in most respects it may be made to respond quickly to war demands. It is weak, however, in six particulars and those should receive immediate attention. As the need for their development is military and not economic, the responsibility for their development rests not upon industry, but upon the Government.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Armor for Tank Tractor Belts

To the Editor of the SCIENTIFIC AMERICAN:

In all the photographs of tanks the traction belts do not show any armored protection. It seems to me that a guard could be placed over the top of these belts and offer considerable resistance to any projectiles hitting same. These guards may have been considered by the military authorities, but if not, they might consider same. In your position no doubt you can easily advance the information to the proper authorities. This is only a suggestion on my part and I hope same may prove a worthy one.

R. D. PETER.

Philadelphia, Pa.

Visible Weather

To the Editor of the SCIENTIFIC AMERICAN:

On December 14th, after several days of storm, my brother and I noticed that the western end of the Big Snowy Mountains, about twenty miles northwest of our place, seemed strangely distorted, the distortion extending about halfway up the mountain. On closer examination we noticed that this distortion was moving from west to east at a tremendous rate, still keeping the same height as when first observed. Because of the similarity of the waves in this effect to the heat waves sometimes seen on a hot summer day we at once concluded that this was a Chinook. The temperature when we first observed the Chinook, at 10.30 o'clock, was four degrees above zero. The succeeding temperatures were as follows:

10.33 A. M.	7 degrees
10.50 A. M.	9 "
11.05 A. M.	12 "
11.35 A. M.	19 "
12.00 noon	22 "
12.30 P. M.	26 "
1.00 P. M.	30 "
2.00 P. M.	34 "
8.00 P. M.	33 "

While this temperature rise is not as phenomonal as a drop of 40 degrees in 30 minutes which I observed on February 3d, 1917, still it is of vastly more benefit to the stockman. Chinooks which occur here are invariably accompanied by a high wind from the west or northwest. Inasmuch as the generally accepted theory is that these winds come directly from the Pacific Ocean it would be interesting to learn why only two or three Chinooks, at the most, occur during a season in which 90 per cent of the winds are high and from the two above named directions.

ROBERT T. POUND.

Lavina, Mont.

Orchard Protection From Frost

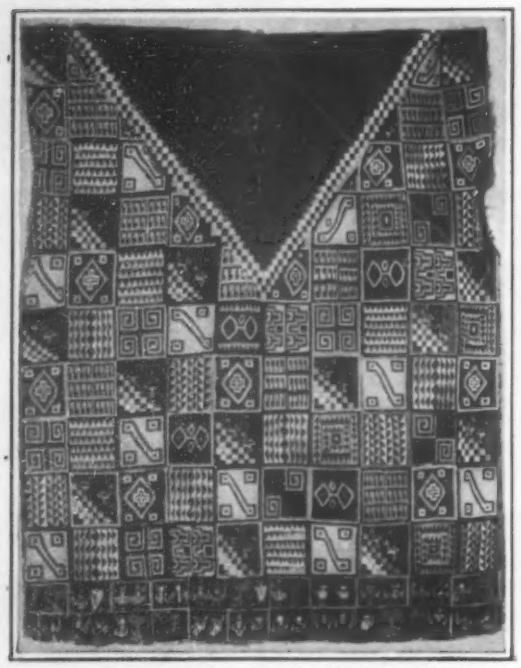
To the Editor of the SCIENTIFIC AMERICAN:

I have a theory with reference to orchard protection from late spring frosts, and I am anxious for an opinion. The orchardist's only protection now from untimely frosts in the blossoming season is in orchard heaters—about seventy to the acre—involving a heavy expense for heaters, fuel and work, and often resulting in failure. Such damaging frosts often occur when the air but a short distance above the tree tops is above the frost line, and if brought down and properly distributed, would save the blossoms. Orchard blossoms on lowlands are often frosted when those a little higher up escape.

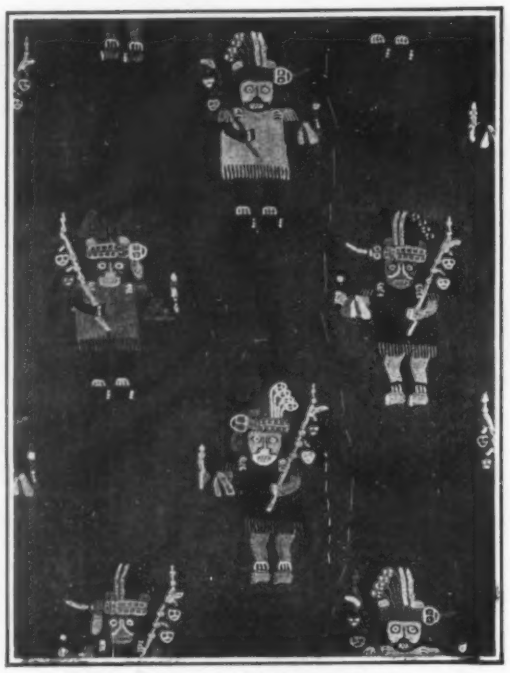
Government tests over valleys at least have shown that on still frosty nights the air at an altitude of about three hundred feet averages 10 degrees warmer than near the valley floor. During the night the warm air near the earth rises and the colder and therefor heavier air from higher levels falls and remains down until sunrise. During the day this interchange of air is continuous, and so rapid in the western valley where I live that whirlwinds from early spring until fall are nearly always in evidence. Some of them, the more violent kind, have a fast lateral movement and the dust raised by them is quickly scattered, but the more sedate kind moving slowly over roads or dusty fields will often lift dust in straight narrow well defined columns hundreds of feet high, and I have seen such dust columns which I estimated at over one thousand feet high. If a natural whirlwind will raise dust in that way is it not reasonable to believe that a mechanically produced inverted whirlwind can be made to reach high enough to bring down air that is much warmer than that in our orchards on frosty mornings? But would the cost be prohibitive? Or could the warm air thus brought down be kept down long enough or distributed over a sufficient area? If the fan used for such a purpose be provided with a short suction tube having tangential openings the required whirling movement would be emphasized and quickly produced.

I hope that publication of this letter will lead some one to try out my suggestion.

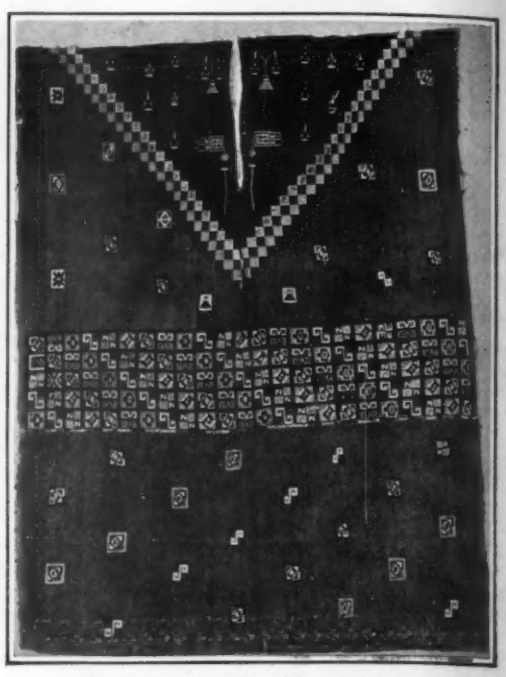
Caldwell, Ida. WARD STONE.



A handsome poncho in brilliant colors from old Peru



A splendid shawl-like garment from Ica



Fine pre-Incan poncho with typical designs

These patterns from ancient Peruvian textiles are being used today as sources for the latest designs

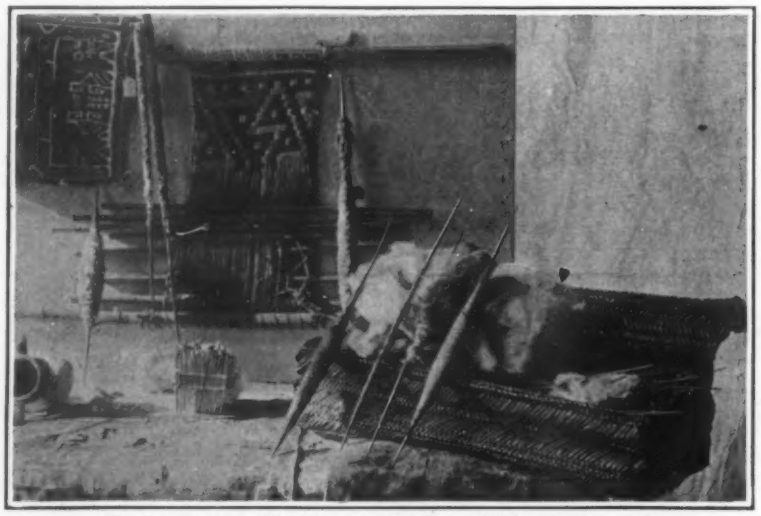
Modern Designs from Ancient Fabrics

Art Suggestions in the Prehistoric Peruvian Textile Collection of the American Museum of Natural History

AMERICAN textile designers, deprived of the usual opportunities abroad, have just found a new field for obtaining fresh and artistic designs of great value in a study of the antique patterns found in the burials of the prehistoric New World. The large and comprehensive collection of Peruvian textiles at the Museum of Natural History in New York, replete with marvelous designs and color schemes, is being used for this purpose. This new field is rapidly gaining the appreciation of great numbers of artists, young and old, who have studied the conventionalized figures and color schemes and applied them to modern wearing apparel.

Toward the encouragement and development of American workers in the entire field of textile and other decorative arts, to give them a thorough knowledge of the importance and value of ancient sources for modern designs as suggested in the great art of the New World, the Museum has made a special display of its great collection of prehistoric textiles and American Indian objects. This new departure in museum research is destined to afford the basis for a typical school of American design, as our designers have formerly relied almost exclusively upon foreign sources for decorative motifs. Already the primitive designs and color arrangements, elaborated from the best and most typical woven Peruvian fabrics, and pottery as well, have had a pronounced influence on the fashions of 1917. The great success of the movement has been aided by a course of lectures especially for textile people, artists, designers, etc., calling their attention to the advantages of a careful study of the Museum's collection. The curator in charge of the South American hall extends every facility to textile representatives and others interested in inspection and study of the Peruvian relics.

The accompanying photographs illustrate some of the wonderful methods of fabric decoration achieved by these ancients. The primitive two-barred loom upon which these beautiful and interesting textiles were made is also pictured, with a partly completed pattern. The fabrics of Peru are beyond all question the most interesting technical and artistic record of textile history. In the absence of written documents, the handicrafts of a nation left behind—usually in its tombs—are our only means of visualizing its history; and an excellent means indeed is thus provided in this instance. The extreme dryness of the air, combined with the nitrous character of the sand, to which moisture seldom found its way, caused the rich and handsomely decorated textiles placed with the Peruvian dead to be preserved for many centuries.



The loom upon which the garment from old Peru, shown on this page, was woven

This high mountain plateau, in ancient times, was the home of the Incas, the most intelligent and celebrated of the aboriginal tribes of Peru. Little by little they gained ascendancy over their neighbors; and during the five centuries preceding the conquest they gained a high degree of culture. After the coming of Pizarro the Inca nation was overwhelmed in the destruction that always followed in the wake of the Spanish conquerors, finally dying out altogether. What they might have been no one can tell; but the skill of their craftsmen promised well for their future, as can be seen from their wonderful weaving and decoration of fabrics. It was the skilled workers of the Inca and pre-Inca civilization that, on the simple loom of frame works, sticks and strings, were able to produce the exquisite specimens here illustrated. In fact, some of their techniques and color combinations far surpass the best work of our modern mills, with their complex machines.

A group of textile designers at work in the museum

Typical of the best work of pre-Incan Peru are the handsome ponchos. These are of a tapestry weave, a class of fabric in which the Peruvians reached their highest development; and the vicuna yarns are so soft and fine as to give almost the feeling of silk. These fabrics antedate the Spanish conquest by 2,000 years and are even more priceless as an art expression than as an exhibit of mechanical skill, uniting exquisite color combination with a fine sense of proportion. The solid color around the neck is a beautiful deep red and the checkered portion is black and gold with occasional red dots. Silver tinsel yarn in considerable quantities is woven into the fabric. This was spun by twisting a thin ribbon of silver about the finished cotton yarn. The warps are three-ply and the weft two-ply. The brilliant coloring of these garments, which cannot be surpassed by the best dyers today, is due to a certain vegetable dye used, the secret of its preparation perishing with the race. Some of the textile specimens obtained from graves are today fresh and magnificent in color and appearance, equalling some of the choicest Gobelin tapestries of modern time.

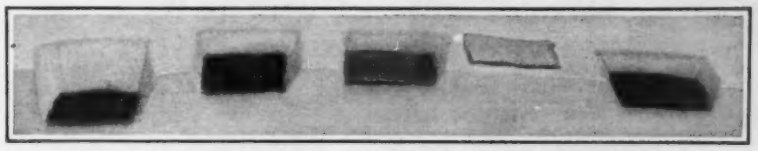
For materials in weaving the Peruvians had cotton of fair staple and of two colors—a snowy white and a beautiful golden brown. Their wool came from the fleeces of three members of the camel family, the llama, the alpaca and the vicuna. The first named wool is coarse, and was but seldom used; the second is well known to us. Vicuna is much finer even than alpaca, and very silky. The loom was of very simple form, just two sticks, one at top and one at bottom, over which the warp threads were stretched. About these threads were the loops that lifted them for the passage of the shuttle. Several cross rods were generally used to keep the threads of the warp in position, and there was a batten to drive home the threads of the woof. Every class of textile of which we know anything today was made upon this loom in old Peru, practically by hand.

One of these splendid masterpieces, containing the most wonderful color combinations, comes from Ica. This is a shawl-like garment, the noteworthy feature being the embroidered designs with a gauze basis. The design decorating this splendid fabric is made up of the repetition in varying colors of a single figure—that of an Inca warrior dressed in poncho, with battle axe in one hand and holding over his shoulder

in the other the heads of two enemies. The figures are in blues, greens, reds, browns and yellows, on a black ground, and worked out in a way that shows a knowledge of color values as fine as any the world has seen. There can be no doubt that this shawl represents the highest development in color applied to textiles.

The weaving art shown in these Peruvian remains is unique in many ways. For one thing, it is the world's one perfect record of the technical and artistic development of a single people, free from all extraneous influence. Even the Egyptians, isolated as they wished to be and as they were, could not shut out the Greek and the Assyrian and the Libyan altogether. But here in Peru there was no neighbor nation capable of giving anything to the Incas, hence there is no trace of outside influence. From the crude to the perfect, a single people have left their record in the time-defying sands.

Cloths of different colors placed on the surface of the snow—



will sink in to different depths because their heat absorptivity differs

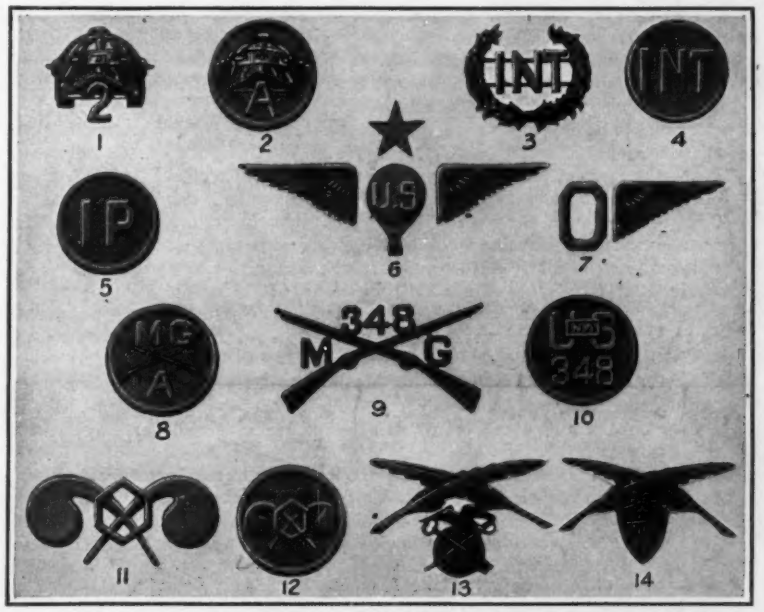
New Army Insignia

By Albert A. Hopkins

Author of "Our Army—Our Navy, How to Know Them"

IT is, indeed, true that the uniform of the United States Army stands for "democracy." The uniform is the same for the major-general and the private with certain additions to indicate rank, branch of service, and personal record. "Insignia" is a term used to include all badges, buttons, braids, hat cords, and other devices which indicate rank or branch of service. An ordinary private's uniform carries no insignia of rank, but when a man becomes a first-class private in the Engineer Corps, Hospital Corps, Ordnance Department, Quartermaster's Corps, or Signal Corps, he is entitled to wear on the sleeves of his coat and shirt, the design of the department to which he belongs. These are technically known as chevrons. Above the non-commissioned officers, the insignia of rank is somewhat easier for the layman to understand, but it is further complicated by additional devices which are authorized by the War Department; thus, a short time ago, the second-lieutenants in the Army were authorized to wear a gold bar on each shoulder, and a stripe of brown braid on the sleeve of their overcoat, of the same pattern as would be worn by the first-lieutenant, only his would be in black. The War Department has just authorized a number of new insignia of rank and profession which we are able, through the courtesy of the Secretary of War, to show our readers.

The "tanks" are one of the great surprises of the war, and naturally we shall take a prominent part in the use of these engines of destruction. Figure 1 is the device which will be worn by officers in the tank service. Figure 2 is the button which will be worn on the left side of the collar by enlisted men in that service. Fighting in a foreign land will naturally call for interpreters who can do a great deal to promote efficiency and coördinate the work of our soldiers with their fellows-in-arms. The "cut-outs" for officers in the Corps of Interpreters is shown in Figure 3, while enlisted men wear the button shown in Figure 4, on the left side of the collar. Enlisted men in the corps of Intelligence Police will wear the button shown in Figure 5, on the left side of the collar. The device for a Military Aeronaut differs somewnat from tne aviator's insignia. The shield with "U. S." surcharged upon it is exchanged for a balloon, as shown in Figure 6, while the observer's device is shown in Figure 7. The Machine Gun Battalions are also probably destined to play a very important part in the war. Figures 8 and 10, show the buttons worn by enlisted men in the machine gun battalions. Figure 8 would be the button for the left side of the collar, and Figure 10 for the right side of the collar, showing that the soldier was a member of the National Army, and the Machine Gun Battalion of the 348th Regiment. The officer's device which should be worn on both sides of the collar for the same regiment, is shown in Figure 9. The Chemical Service is also an entirely new branch of service. Officers will wear the "cut-outs" shown in Figure 11 on both sides of the collar, while enlisted men will wear the button shown in Figure 12, on the left side of the collar. Field clerks of the Quartermaster's Corps and the Adjutant-General's Department, will now wear two crossed pens above the device, indicating their branch of the service.



Showing some of the new army insignia of rank and profession lately authorized by the U. S. War Department

Curious Cloth Testing

SO old that it may be new to many of our readers is a scheme originally carried out by Franklin, and recently revived in England, for testing the heat absorptivity of different colors. Small squares of cloth of exactly the same material but varying in color were prepared. These were placed out on the snow in full sunlight. At the end of an hour the pieces were examined and, as is seen in the accompanying photograph, some very interesting results were secured. The black cloth had sunk right down into the snow until it was completely in the shade. The red piece was down to about half the distance. The light blue was only just below the surface while the white cloth was unaffected by the rays of the sun. The yellow portion sank down to about the same depth as the red. These tests show the degree of warmth of clothes according to their color.

Tagging Fighting Men for Identification Purposes

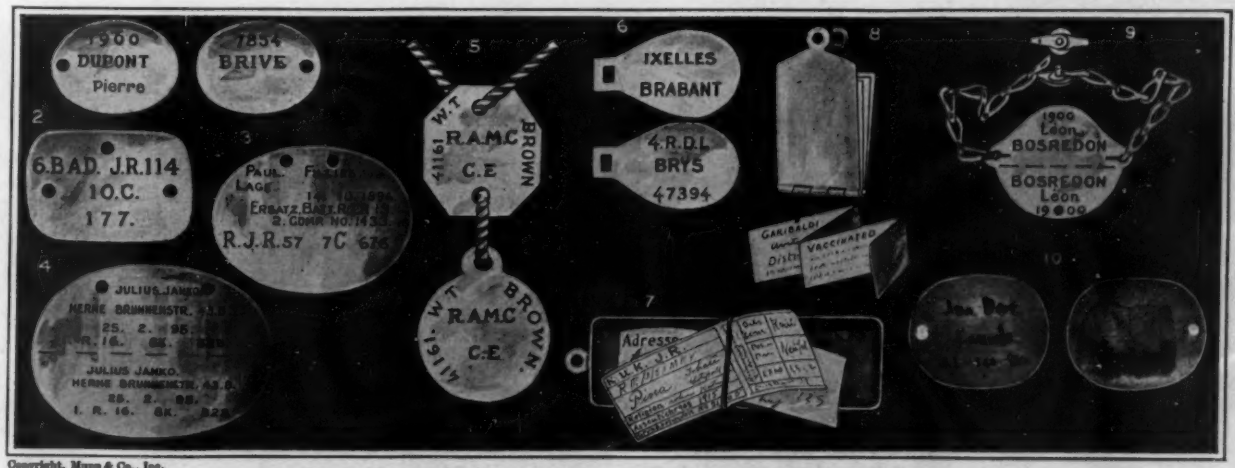
THE modern soldier must be tagged. In former times the fighters were for the most part professional warriors or were recruited from the same localities, so that in either case they knew one another. And after a battle both sides were usually willing to enter into an armistice for the purpose of picking up the dead and wounded, and ample time was therefore available for the identification of the fallen. But today things are entirely different.

So vast are the armies engaged in the present war that they are no longer professional fighters. They are recruited from the citizenry of a country; and they come from all sections and all classes. Often the members of a single command do not know one another. During battle various commands are thrown together, mixed, or changed about, until it is well nigh impossible to identify the dead and wounded by any other means but identification tags. Then there are other reasons: war's weapons so mutilate the fallen that ordinary means of identification fail completely; the killed must need remain on barbed wire entanglements or lie between the lines for days, until decomposition is pretty well under way and identification is impossible; again, lights are often not available on the battlefield, and identification must be carried on in pitch darkness.

All these conditions were presupposed long ago. Most of the armies entered the present war with some permanent identification tag, for the idea is by no means new. Indeed, in our Civil War the soldiers were provided with identification cards carrying their names, regiment, brigade, division and corps. These cards were suspended at the neck by a cord on the shirt. In the war of 1870 the Prussian troops were provided with tin identification tags which were again employed by them at the beginning of the present war. The French troops fighting in the vicinity of Paris during the short Franco-Prussian war, on their own initiative provided themselves with identification records on linen, which were sewed in the hat. Despite the fact that many of these records became more or less unreadable after a short time, they served, as a whole, to good advantage in identifying many of the fallen. The French Minister of War was so impressed with the idea that he adopted a German silver identification tag for each soldier, which, until the present war, was kept at his mobilization depot.

Thus the French entered the present war with an identification tag for each soldier, of the type shown in the accompanying illustration. For a time the German silver metal was replaced by aluminum, but the latter material proved unreliable for long use and was therefore replaced in turn by German silver. The identification tag was originally intended to be worn on a string passing about the neck, and hidden under the shirt. But at first the African soldiers and later others showed a preference for wearing the tag on a chain about the wrist, and today the majority of "poilus" wear it in that fashion.

In the beginning each French soldier was provided with a single identification tag; but in 1915 it was decided to provide two instead, so that for identification purposes one was to be removed by the authorities and the other was to remain on the body for the identification of the remains at any subsequent time.



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Various types of identification tag worn by the fighters in the world-war

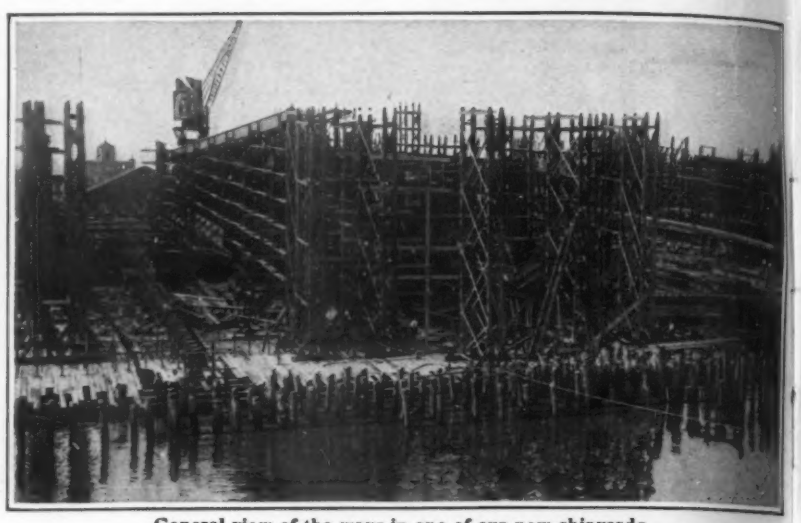
In the numerical order shown, the types are: (1)—Two sides of the French tag. (2)—Identification tag worn by German soldiers at the beginning of the war. (3)—German tag of 1915. (4)—Present tag of the German soldiers. (5)—Two-part identification tag of British soldiers. (6)—Two sides of the Belgian tag. (7)—Locket and records worn by Austrian soldiers. (8)—Book-like locket and records worn by Italian soldiers. (9)—Improved split tag designed by Dr. Bosredon for French warriors. (10)—Two sides of our Navy finger-print identification tag.

At first the French sailors had a tag of their own with the data in the form of cut-outs, but in November, 1915, this was replaced by a tag identical to that of the army.

Turning to the British Tommy, we find him provided with a circular aluminum tag hanging on a string about the neck, and containing such information as his draft number, his initials and his name, regiment, and religion.

(Concl'd on page 153)

A great shipyard rising from the marshlands near Philadelphia



General view of the ways in one of our new shipyards

Are We Building Real Ships?

If So, Why the Delays and Doubts?

By A. C. Laut

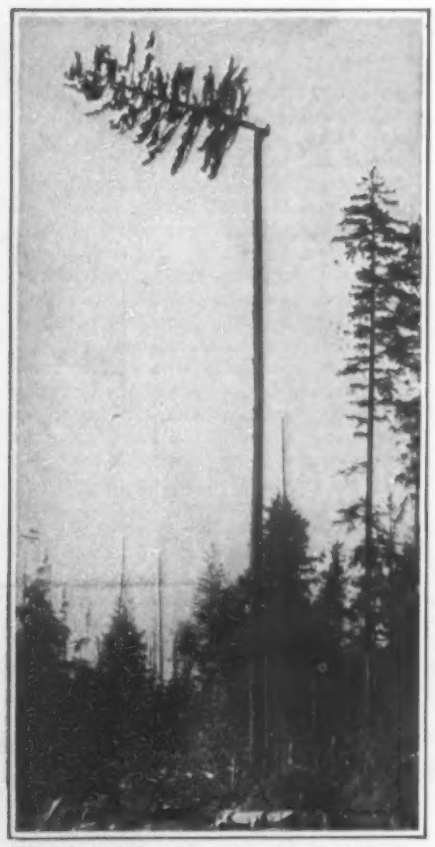
Photographs Copyrighted by Underwood and Underwood

ONLY six years ago, there were barely seven shipyards doing active work in the United States. That is—out of the seven big yards, perhaps five were actively employed all the time, two running lamely along on part time. Today, the seven old yards are full up with Navy orders, which will busy them to 1920, and 132 new yards, or old yards revived, are at work night and day, two and three shifts at a time, on contracts for the merchant marine of the Emergency Fleet Shipping Board. We used to turn out some 250,000 tons of shipping a year—the most of that for barge, towing and coastal traffic. By 1917, we were turning out 800,000 tons a year; what with the vessels commandeered from coastal traffic—some 2,500,000 tons—and the vessels for which the Emergency Fleet has let contracts—5,517,000 tons—we shall have available for Atlantic trade some eight million tons by the end of 1918, not counting the 787 vessels for which the Navy has let contracts.

These are fact-truths of what is being done, not blue-print theory promises of what is going to be done. Millions of rivets are being driven by hundreds of thousands of workmen on real ships above real ways. If the song of the rivets could be gathered up from Fore River, Boston and Newark Bay and Delaware and Newport News clear round Mobile to Seattle and Tacoma, it would be the biggest anvil chorus ever sung by a giant nation to the glory of the freedom of the seas. It would be a chant going clear around the world heralding the birth of a great marine power rising mistily, a second Carthage, from the cradle of the seas.

When I visited the shipyards of the United States some six years ago, it was like a visit to a procession of morgues. The industry was dead, or dying. Every yard but one was running at a bank-breaking loss. The Inland Empire of the Middle West was saying—"Let it die: why should we subsidize our ocean carriers? Let foreign ships carry our ocean freight. What is a merchant marine to us?" When I visited half a dozen of the yards round New York and Philadelphia in January of 1918, I could not hear my own thoughts, let alone my own voice, for the rip-rap-rap of a million rivets being driven, the pound and thug of tens of thousands of piles being automatically placed by huge machines, the shout of workmen and noise of truck and train, where in one yard as many as 7,000 carloads of material were being dumped. I wanted to go off by myself to some quiet corner of the yards where no workmen would be and brood over the meaning of a powerful nation girding itself to become a great marine power; but as a matter of fact, there is no quiet corner in the yards; and now that electric light is to permit three shifts a day, there will be no time when no workmen are there. At the present moment, 200,000 workmen are busy in the merchant marine yards alone. When electric light is installed, from 500,000 to 600,000 men will be at work.

The West no longer asks: "What is a merchant marine to us?" It found out what a merchant marine is to us, when British and German shipping became absorbed in war work and for the last four months of 1914; cotton fell in price to 4 cents and wheat to 67 cents. Only when the sea lanes opened did the price go back to normal; but the insular indifference of the Middle West had at last been stabbed alive to what a merchant marine meant. The Middle West had learned that a merchant marine meant the price of wheat,



Chopping off the top of a Douglas fir 180 feet above the ground

Carrying logs down a 300-foot skidway to the river below

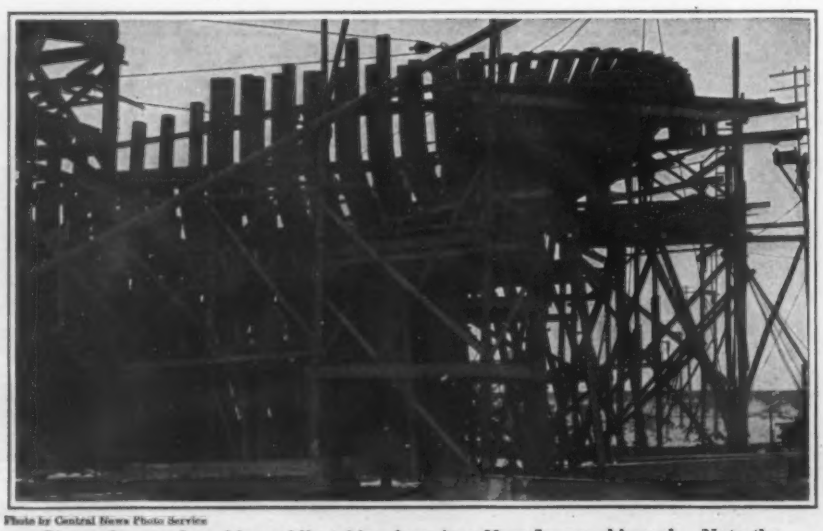
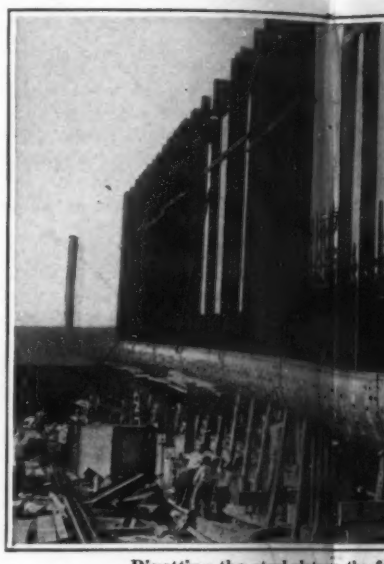


Photo by Central News Photo Service

Stern of a wooden ship rapidly taking form in a New Jersey shipyard. Note the forest of scaffolding required

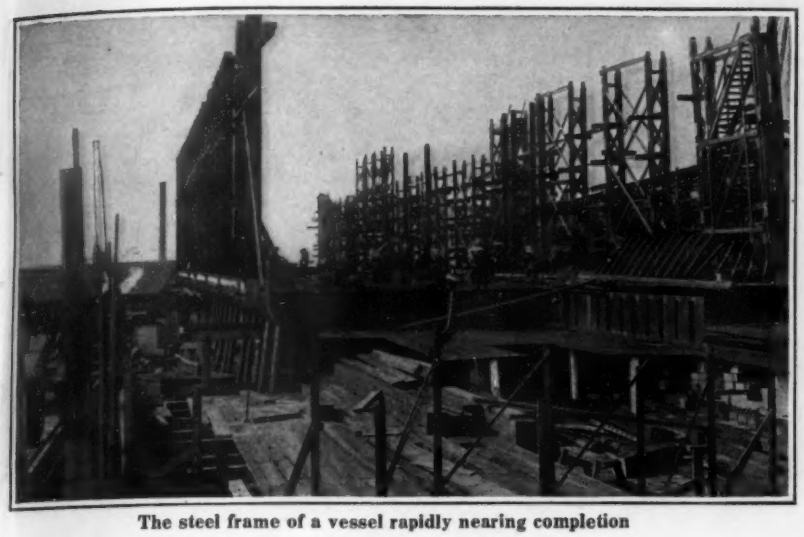


Rivetting the steel plates to the fr

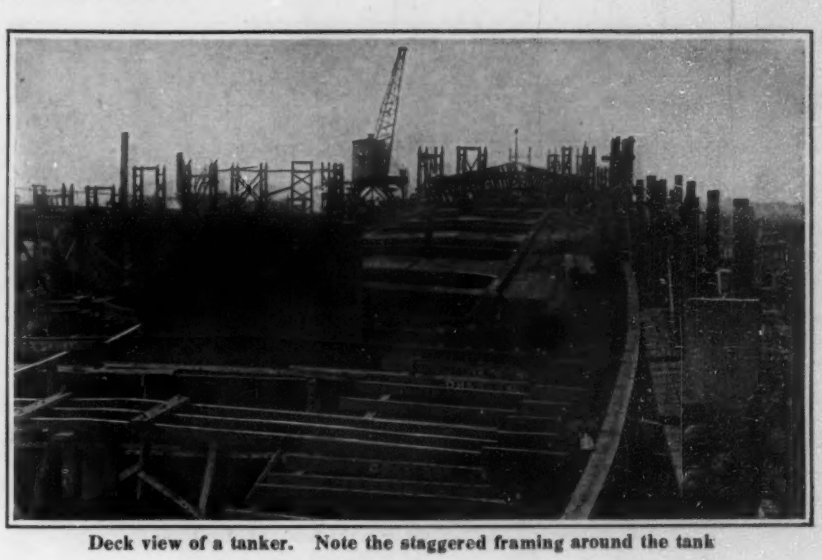
Building a thousand-ton tan

Photo by Central News Photo Service

At one of the Atlantic coast yards. Interior [illegible] the st



The steel frame of a vessel rapidly nearing completion



Deck view of a tanker. Note the staggered framing around the tank

plating the frame of an oil tanker

and-gidon tank in an oil tanker

Interior view of a wooden ship, looking toward the stern

of corn, of cotton, of beef. Also the new method of building ships has aroused in the West an enthusiasm for a merchant marine that is becoming a passion. It has moved ship building from shore front inland to every factory and shop and industry that can manufacture what goes into a ship. The new method is known by the name of standardizing.

What is standardizing? It is what Ford has brought to such perfection in his motor factories—the manufacture in multiples of tens and hundreds of thousands, of the parts going into a machine—then the assemblage of these parts in the main factory. Standardizing has been in vogue in structural steel, bridge work and tanks for fifteen or twenty years. It may be said it required the combined work of 75 engineers to perfect standardizing for bridge work. In Great Britain, standardizing has been in practice with the shipyards for a quarter of a century; and it decreased the cost of ships from forty to sixty per cent. That is—each yard would build only one size and type of ships; but for this type of ship it would have many ways. The parts of this ship would be manufactured in many factories in multiples of thousands—plates in one factory, rivets in another, boilers in another, engines in another, and the main shipyard would be only a swift assembling plant. But in America, we were still following the old-fashioned slow method. A dozen different types of ships would be in the same yard on the ways at the same time; and the cost was proportionately higher than abroad.

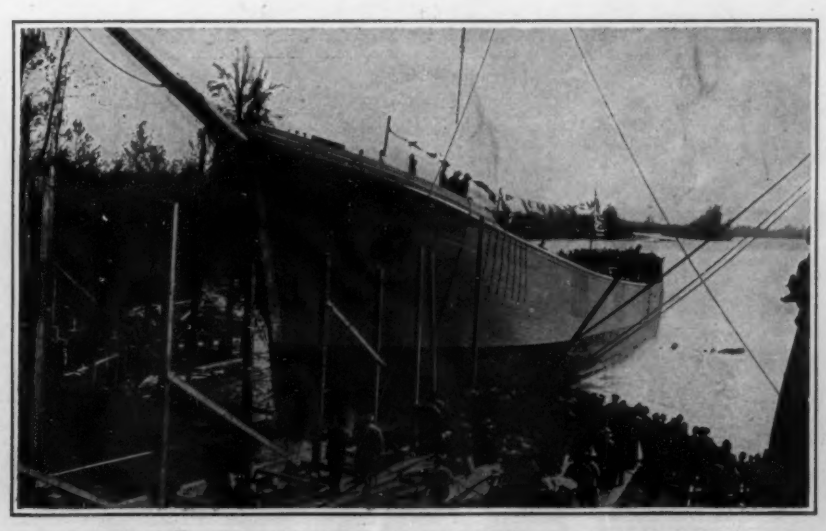
The change to standardizing in America had been advocated by Homer Ferguson of Newport News for some years; but only the fearful pressure of the war forced the use of the better and newer method. Sutphen, of a motor boat construction company, happened to be sitting at a down-town luncheon next to a British Admiralty officer, who had come to America to see what could be done to meet the submarine peril. Speed, speed, more ships and speed were all that could beat the submarine—speed in engine power and speed in construction. Sutphen happened to remark that if the Admiralty would take standardized uniform chasers, they could be built with incredible speed. The Admiralty man answered, "Go to it," and 550 submarine chasers were delivered in a period that Germany did not believe possible till she had lost 84 per cent of her submarines.

So when the Emergency Fleet Shipping Board came to the problem of building a merchant marine faster than the tonnage of the Allies could be destroyed, the question was—why not standardize? Let ships of a uniform size only to each sea-front yard—then farm out the contracts for the parts of these ships to the hundreds of inland factories. So contracts were let—to one yard ships of 3,500 tons, to another of 5,000 tons, to another of 8,000 tons and so on up to 10,000 and 12,000 tons—some of the contracts for wood, some for steel. The component parts were then ordered from inland factories. Or rather, they were commandeered. The raw material for these parts was then ordered, or rather commandeered. The entire output of 43 different steel factories was requisitioned for the steel ships alone; and the entire output of 600 other factories for all the ships, steel, wooden and composite. The first big benefit of standardizing was—speed.

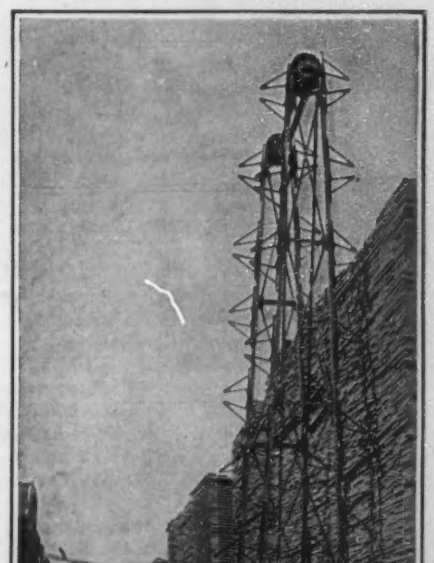
The second big benefit was to scatter the high wages paid for ship work all through inland America—through that Middle West which used to ask bellicosely—"What's in a merchant marine for us?"

The third big benefit was to recruit for ship building a force of laborers attached to inland factories all over the country. This, of itself, solved the problem of housing and congestion for the factory man on the shore front. Only 18 per cent of the actual building will be done on the shore front; 82 per cent is done in the fabricating factories. If it is embarrassing us to house 500,000 men, who are doing 18 per cent of the work for the new merchant marine yards on the shore front, what would have happened if we had had to house the workers who are doing 82 per cent of the ship work? We could not have had our merchant

(*Concluded on page 156*)



Launching the "City of Oregon" at St. Helens, Oregon. This is one of the largest motor-driven ships



Electric lumber stacker which does the work of four or five men

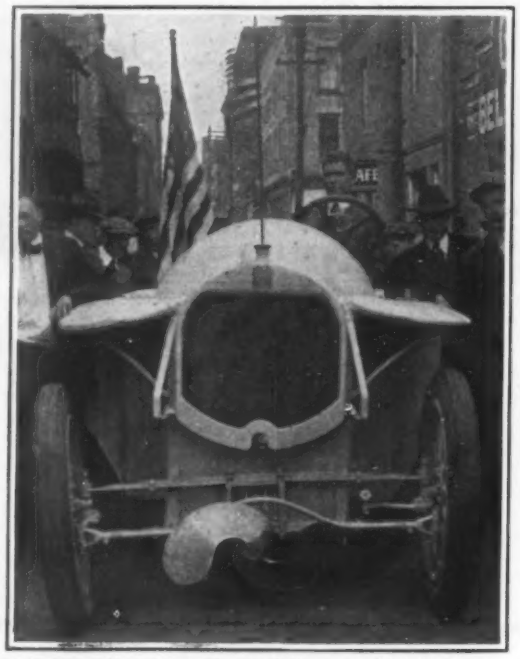
Building a two-mile flume to float logs over otherwise impassable ground

The Motor-Driven Commercial Vehicle

Conducted by VICTOR W. PAGÉ, M. S. A. E.

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles

The hydrocar taking to water



The propeller at the front of the car which becomes the stern of the boat

Hydrocar with wheels removed used as a boat

Combination Land and Water Vehicle

NUMEROUS attempts have been made to combine in one vehicle, a hybrid type that would have the characteristics of either the automobile, when traveling on land, or a motor boat, when used in the water. Naturally, any attempt to solve this problem involves a careful consideration of engineering principles that are not difficult to apply in the case of either vehicle if used singly, but which are exceedingly difficult to reconcile when the two are to be used in combination.

A recent attempt to solve this problem is shown in the accompanying illustrations. The vehicle may be used on land as a 1½-2-ton capacity motor truck, capable of a speed of 25 miles per hour and can also be used in the water owing to the watertight construction of the body and motor compartment, where it will attain speeds of eight or nine miles per hour. It is believed that a vehicle of this character may have advantages for war use and can be employed by engineering and signal divisions of the army.

The common power plant is used for propulsion, both on land and in the water. When the vehicle is operating in the water the propeller placed at the front end of the car, is shifted into gear by an ingenious hand-actuated clutch mechanism, so that it is rotated at the required speed. What is the rear end of the car on land becomes the bow of the boat in the water. The steering is accomplished by the same steering gear, as disks attached to the front wheels perform the functions of rudders on a boat. While the type shown is provided with a chain drive, it is stated that new models are to be equipped with a completely enclosed shaft-gear drive system that will not be affected by water, inasmuch as the parts will revolve in oil-tight and water-proof housings. The arrangement of the axles and auxiliary parts is such that if the vehicle is to be used for any length of time in the water they can be removed and their impeding action or resistance be eliminated, which will give the craft considerably more speed. The body is of steel and while it cannot be shaped on the best streamline form on account of the projecting axle parts and operation of the suspension mechanism, at the same time it does not offer as much resistance as its appearance would indicate. Of course, when the axles are removed, filler plates are supplied to improve the outline and reduce the resistance. The car is equipped with 50 horse-power, four-cylinder engine of conventional construction. It has a three-speed and reverse selective change speed gear box of the usual form.

Speeding Up Deliveries by Quick Loading and Unloading

EXPERIENCE has demonstrated that nest bodies and demountable types greatly increase efficiency by decreasing time consumed in loading and unloading. To increase the volume of work performed by a motor truck in a given period of time and thus reduce the cost of hauling, many enterprising truck users have improved their shipping facilities for the handling of merchandise. Many others have grasped the opportunity to employ special loading schemes which reduce labor, but do not disturb their general plan of handling goods. In many lines of business the loading of packages individually is just about as wasteful as the loading of a coal truck by shovel. Undoubtedly the special loading systems which are most popular and most easily installed in mercantile lines of business are those which employ nest bodies, removable bodies or loading crates. Being adapted to the handling of many kinds of merchandise, all of these removable types have been widely used with good results.

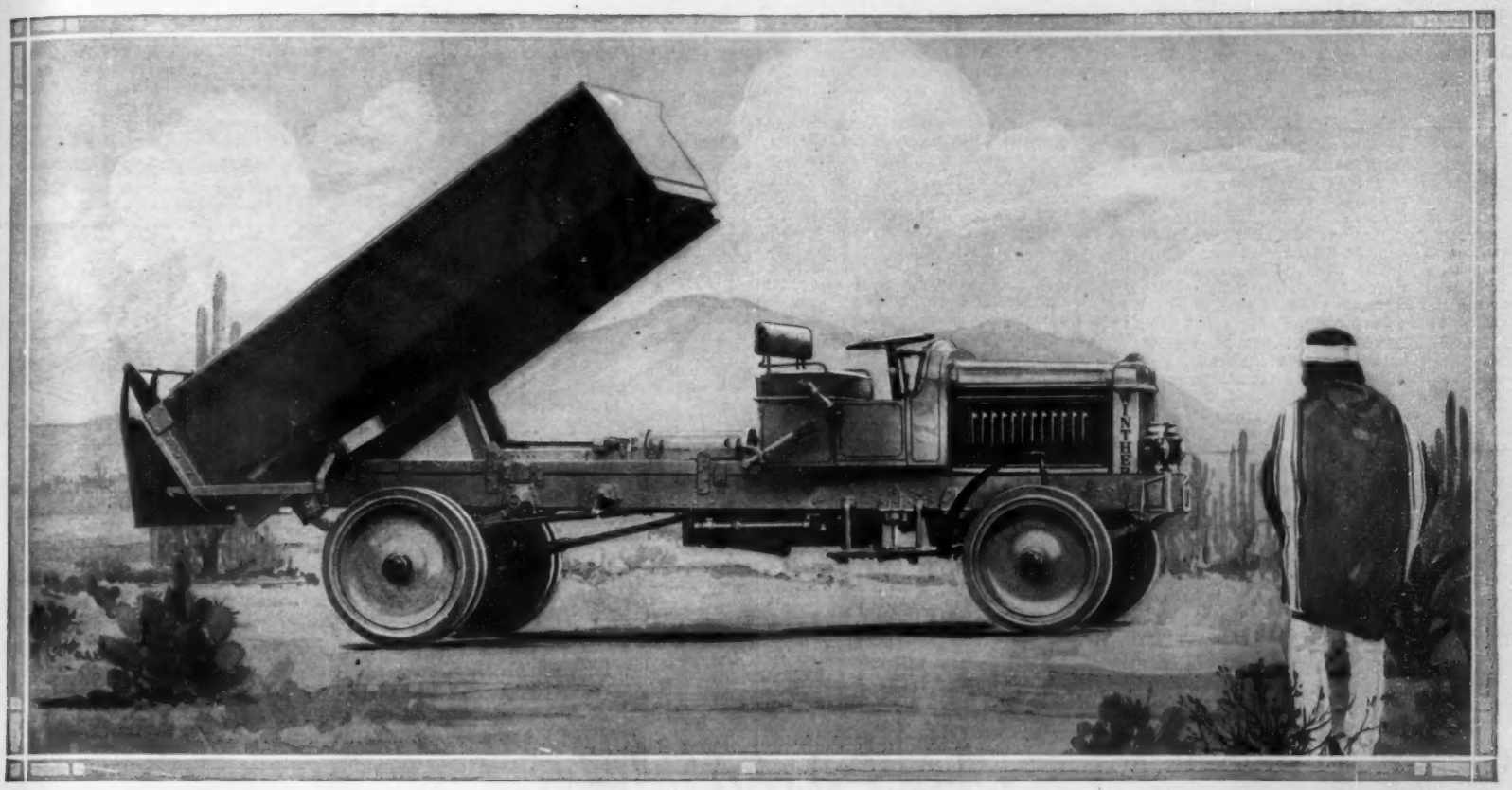
Any plan which reduces the idleness of a truck at the loading platform is an improvement worth making, provided only that the time saved to the truck can be utilized in actual hauling. To reduce the loading time to its lowest point is to create many advantages, other than enabling a truck to deliver more merchandise. In giving a truck more hours of productive work the nest or removable body permits the loading of the detached bodies at the most convenient time and in the most convenient manner. It saves space on the shipping room floor, eliminates congestion on the platform and often simplifies the work of routing and checking. Another point in favor of the nest body is that its adoption does not in any way affect the original carrying capacity of the truck, because the truck may be used without the nests whenever it is advisable to do so.

Illustrations accompanying this article show several types of nests and one type of body which may be completely dismounted. Nest bodies may consist simply of smaller bodies, mounted on casters and built in such sizes that they will roll into the truck bodies. Or, they may be composed of a series of uniformly-sized bins such as are used to move material or finished goods from one department to another. This is the plan adopted by a large textile manufacturing plant, and can also be used to advantage by department stores. The shipping platform of a large pottery is built with rollers to facilitate the mounting and dismounting of the truck body as a unit, because the material carried is heavy as well as bulky. The loads transported by this truck consist wholly of red earthenware flower pots and the hauling is long distance work exclusively. The truck's performance is aided by the removable body system, because it is not tied up at the platform while the flower pots are being carefully packed and loaded. While one body is being loaded, the other one is on the road, and no time is lost when the truck reaches its destination, because the body may be left to be unloaded when conditions permit.

By using nests this truck is freed of loading delays

Saving time by the use of demountable bodies

A rapid loading system employed at a mill in Lawrence, Mass.



A Winther Now for Every Need

WE make an announcement today which is of the utmost importance to every American business man.

There is now available a Winther Truck for every trucking need.

Consider please what this means to you.

No matter what size units you require, no matter what variation of size and capacity now or which you may add in the future there need be no substitution of trucks of lesser quality.

You have available now Winther Trucks of every size from one to seven tons, Winther low costs for maintenance and operation, Winther freedom from trouble, Winther standard of reliability which have set a new mark in motor truck building.

For every Winther Truck of whatever size is based upon the self same principles of design and selection of materials which marked the first Winther Heavy Duty Truck.

Note please that since the first Winther took the road never has it been necessary to make a single change in the fundamental Winther design.

The reason for this is as simple as A B C. All Winther Trucks are the direct result of the wonderful lessons of Mexico which changed almost in a day the whole knowledge of motor truck building.

Out of that melting pot of military service into which was poured half a hundred trains of 27 to 33 trucks each, a great symposium of America's best, came a new truck produced to match the new standards of commercial truck construction there found necessary.

It is a far cry from the desert trails of Mexico to the commercial highways of the old U. S. A.—perhaps.

But those same Mexican trails hold a lesson of vital interest to every motor truck user in America—to every American manufacturer with a transportation problem to solve.

From the lessons learned there, it has been possible to produce a truck freer from those faults and weaknesses heretofore considered inherent in motor truck transport—a truck of lower maintenance costs—of lessened repair expense—of higher day in and day out use—a truck of naturally immeasurably wider service.

With a new plant, unhampered by old policies or investment to protect—rich in experience and with ample capital, it has been possible to utilize to the fullest extent the fundamental facts of high grade motor truck building now known to the industry.

Winther Internal Gear Driven Trucks are not an experiment, neither are they "cheap" trucks. A mere statement of the materials entering into their construction would serve to convince even the laymen of their quality. They are produced by men who "know how".

And remember—there is a Winther Truck for every need. This is, we believe, the first time in the history of the motor truck industry where a complete line of trucks of this quality has at once been available. They vary only in size and capacity.

Winther Trucks have now been in service for over a year. Distribution is country wide—another record, we believe, unique.

Go to the Winther distributor nearest to you—we will tell you who he is, if you do not know him—let him tell you the story of Winther, show you the truck and place at your service without obligation the Winther Traffic Engineers, who will gladly cooperate with you in a discussion and solution of your traffic needs.

Let us, also, send you the "Story of Winther," full detailed specifications, etc.

Model 28 Maximum capacity 1 ton Model 88 Maximum capacity 4 tons
Model 48 Maximum capacity 2 tons Model 108 Maximum capacity 5 tons
Model 68 Maximum capacity 3 tons Model 128 Maximum capacity 6 tons
Model 148 Maximum capacity 7 tons

Winther Motor Truck Company

Dept. H, Winthrop Harbor, Illinois

RECENTLY PATENTED INVENTIONS

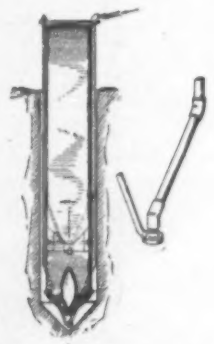
These columns are open to all patentees. The notices are inserted by special arrangements with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of General Interest

HOTEL ROOM RACK.—F. W. SENN, Hotel Biltmore, New York, N. Y. Among the principal objects which the invention has in view are: to provide a rack which may be removed from its normal supports for comparison or other purpose to be replaced after such purpose has been accomplished; to provide a rack adapted for indicating advance data in relation to the rooms, and to provide racks adapted to be arranged within small space.

EYE-WASHING DEVICE.—F. MAIER, 231 Niles St., Elizabeth, N. J. The invention provides eye-washing devices, comprising cups to fit over the eyes and having an inlet and outlet for water and other liquids employed for washing, the fronts are transparent, nipples are provided at the inner and outer sides, the outer nipple of each cup being adapted to receive a tube for the liquid to flow through to permit the eyes to be washed.

PILE AND METHOD OF SINKING SAME.—E. F. ESTES, 1315 E. St. Lincoln, Neb. This invention has for an object to utilize the hydraulic jet system in connection with piles and sinking them by an up and down motion. The invention is particularly adapted to assist in sinking concrete piles, a special form of pile is provided, with



SIDE ELEVATION OF CONCRETE PILE, AND RING FOR SECURING JET PIPE TO THE PILE

means for securing a central jet at the lower end, the force of the central jet mixing earth and water into thin mud and permitting the pile to drop direct without a side resistance.

DENTAL PROCESS.—H. W. BABCOCK, P. O. Box 366, Onarga, Ill. The object of the invention is to provide a simple, inexpensive and easy method of crowning teeth by the so-called jacket crown, wherein the method may be carried out by the average dentist without special equipment and at a reasonable fee.

GASOLENE AND OIL RENOVATOR.—G. CAEN, Sr., address Early Northrup, 1587 North Flores St., San Antonio, Texas. The object of the invention is to provide a device, for freeing soiled gasoline, oil and the like from impurities, and putting the products in condition for reuse. The device comprises a casing, a filter with concentric inner and outer walls closed at their bottoms and of porous carbon, and a filtering compound between the walls.

PROCESS FOR PRODUCING ALUMINUM COMPOUNDS.—F. LANGFORD, 1112 J St., Eureka, Cal. An object of the invention is to provide a process by means of which aluminum compounds may be economically produced from aluminum ores. A further object is to produce compounds of aluminum such as aluminum oxid from ores that are not commonly used for that purpose.

EMBROIDERY HOOP.—W. A. FINLEY, Fairmount, W. Va. One of the principal objects of the invention is to provide means for compressing the outer ring of the hoop upon the inner ring, to secure the cloth upon the hoop, including means for adjusting the outer split ring upon the inner one, by a lever whereby the range of adjustment of the outer ring may be varied

SUBMARINE TRAP.—I. LUDLOW, 700 West End Ave., New York. Among the principal objects which this invention has in view are, to sink a submarine to depths where the static pressure is greater than the resistance of the submarine hull, to destroy a submarine by changing the riding angle, to entangle and prevent the disengagement of a submarine, to recover the traps if they become released accidentally and to optically locate an invisible submarine.

SHADE SUPPORT.—A. B. SMITH, 4537 Vonverson St., St. Louis, Mo. The invention has for its object to provide a shade support having brackets which are connected by telescoping members, the vertical portions of the brackets being regulated by a cord secured to the bracket and disposed around pulleys mounted on frame, members detachably secured to a window frame, the frame members having guides which engage each other.

APPARATUS FOR TREATING MILK.—W. A. HOETH, Greenfield, Wis. The invention is an apparatus for treating milk as it comes from the cow, by which it is strained and raised or lowered to any desired temperature. The latter is varied according to the use for which the milk is required. If it is to be bottled and marketed the degree of temperature can be kept much lower than if it is to be passed through a separator to prepare it for delivery to creameries.

SUBMARINE VESSEL.—A. R. LENDNER, 204 W. Emerald St., Los Angeles, Cal. The object of the invention is to provide mechanism in connection with vessels wherein a particular form of ballast is provided capable of flowing from the chamber through a reduced opening and having a higher specific gravity than water, and so arranged that it may be discharged at will to cause the vessel to immediately rise to the surface.

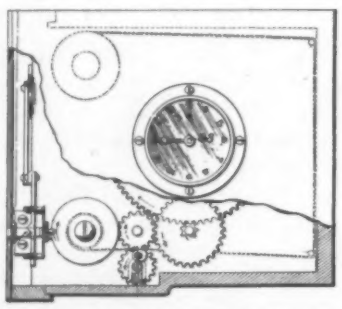
TATTING SHUTTLE WINDER.—W. A. BARNETT, 1501 Yon St., Lincoln, Neb. An object of the invention is to provide a device for winding tatting shuttles of the type in which a pair of bowed sides is provided with a fixed reel or bobbin, and in which the thread is wound on the bobbin by passing it between the ends of the bows. Further objects are to provide a device in which one of the spring bows may be held apart from the other, in order to facilitate the entrance of the thread, and in which the tension of the thread may be increased or decreased for winding tightly or loosely as desired.

COPY HOLDER ATTACHMENT FOR TYPEWRITERS.—W. E. GRAY, address Bartels & Blood, 728-735 A. C. Foster Building, Denver, Colo. The present invention relates more particularly to structural improvements in the line spacing mechanisms described in patent No. 1144190 granted to the same patentee, June 22d 1915. The object is to simplify the construction of many of the parts in order to increase their effectiveness and reduce the cost of manufacture. Another object resides in the adjustment of the parts and their susceptibility of dismantling, of the copy holder itself.

SEDIMENT TESTER.—G. A. WILSON, Chase Mills, N. Y. The present invention relates generally to testing apparatus, and more particularly to apparatus for testing the sediment of milk, the object being in the first instance to provide a sanitary apparatus fully answering the standard health law governing the production of devices of this nature, and one which will be effective and efficient in use. The parts may be readily disassociated for cleansing purposes.

DISPLAY STAND.—C. W. PAGE, American National Bank Building, Richmoned, Va. The object of this invention is to provide a stand adapted for use on show cases, for containing small packaged articles, as for instance, chewing gum, wherein a container is provided for receiving the carton containing the packages of gum, and having connected therewith an ornamental panel which rests upon the top of the showcase to hold the container in inclined position.

CAMERA ATTACHMENT.—MARGARET FEILD, care of T. J. FOX, 580 N. 4th Street, Memphis, Tenn. The invention relates more especially to camera attachments designed to automatically shift the film in a hand camera,



PLAN VIEW OF A PORTION OF DEVICE, PARTS BEING SHOWN IN SECTION

when the shutter operating lever is moved, as in the act of taking a picture. A further object is to provide a device which is simple in construction and operation, and therefor not liable to easily get out of order.

TOBACCO PIPE.—C. F. MEISSNER, 4352 Orchard Street, Frankfort, Philadelphia, Pa. This invention relates to pipes for smoking tobacco and is of the well known hooka or hubble-bubble type, one of the main objects being to provide a pipe having the advantages of a hooka and at the same time being used in the manner of conventional pipes because of its portability.

BEVERAGE.—D. COZZOLINO, La Cresenta, Cal. The invention relates to a fermented beverage similar to beer, in which the malt is totally replaced by fruits, grapes, or any fruit, including berries can be used for the purpose, or their juices, syrups, or fermented musts. The object is to produce a beverage possessing a great variety of flavors and colors which will make the drink more attractive.

CURTAIN SUPPORT.—W. E. KURTZ, 1419 So. New Hampshire St., Los Angeles, Cal. The general object of the invention is to provide a curtain supporting means in which the wheeled curtain carriers are arranged to travel on tracks provided in a tubular supporting element in which the axles of the wheeled carriers are so formed and so arranged relatively to the supporting tube as to maintain the carriers against displacement.

AUTOMATIC LANTERN SLIDE PROJECTOR.—G. B. Alguire, 508 Colorado Ave., Chickasha, Okla. An object of the invention is to provide a device by means of which a series of lantern slides may be automatically brought into position for display and may be left in this position for a given length of time and thereafter be removed and replaced in original order so that the operation of the machine may be continuous.

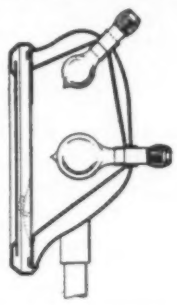
DEVICE FOR HANDLING CUSPIDORS.—J. GIANNINOTO, care of Manhattan Briar Pipe Co., 425 Greenpoint Ave., Brooklyn, N. Y. The object of the invention is to provide means adapted to be applied to a cuspidor, whereby to enable the same to be lifted and carried to a place of dumping and the carrying means then manipulated to dump the cuspidor, the purpose being to minimize the unpleasantness of the work.

Pertaining to Vehicles

AUTOMOBILE ELEVATOR.—V. T. WRIGHT, R. No. 4, No. 134 Corsicana, Texas. The invention has for its object to provide mechanism which may be arranged in garages and like places for elevating the car and supporting it with the tires out of contact with the floor, wherein the movement of the car is utilized to operate the elevation. The invention comprises an inclined trackway, up which the car is run, and locked in position by a ratchet bar.

ELECTRICALLY OPERATED SPEED LIMITING DEVICE FOR MOTOR VEHICLES.—H. M. KAMMERHOFF, 159 Cleveland St., Orange, N. J. The general object of this invention is to provide an electrically operated speed limiting device which can be adjusted for various speed limits so that if the car attains a speed in excess of a predetermined limit the supply of mixture to the motor is automatically cut down so as to decrease the speed.

AUTOMOBILE HEADLIGHT.—B. T. MERRIL, 404 Second Ave., N.E., Puyallup, Wash. It is the object of the invention to provide a headlight in which all upwardly directed rays maybe cut off thus all glare eliminated in order to avoid



A VERTICAL SECTION

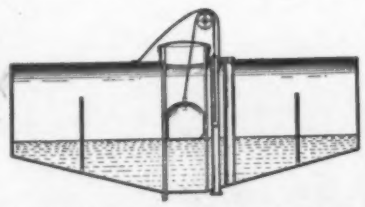
collisions ordinarily due to light blinding. In order to accomplish this the invention provides means supplemental to the usual reflecting surface, and axially disposed light source, whereby when the latter is extinguished, only those rays which are downwardly directed will be given out so that while the roadway remains sufficiently lighted, all blinding glare is eliminated.

TIRE BUILDING CORE.—P. AND B. DE MATTIA. This invention comprises a plurality of core sections, each provided with a setting flange, the flange being tapered in cross section; a continuous lining ring having a continuous annular groove, the groove being shaped in correspondence with the flanges, and means for holding the ring and flanges in service relation; the means embodying a flange deposed in spaced relation to the back of the ring in service, and a wedging member adapted to rest between the flange and the back of the ring.

POWER TRANSMISSION.—J. P. MARTINY AND S. THON, Rooms 14 and 16, Nisbett Bldg., Big Rapids, Mich. This invention has for its object to provide mechanism adapted to be used in motor vehicles, wherein means is provided for connecting the motor with the front wheels, to provide for a four wheel drive, without interferring with the turning of the wheels to guide the vehicle.

SHOCK ABSORBER.—S. E. SANDERSON, care of Sanderson Co., Town Creek, Ala. One of the principal objects of the invention is to provide a shock absorber adapted for use with road vehicles, particularly automobiles, so designed that while it will not prevent the springs of the vehicle from yielding to the roughness and unevenness of the road, it will prevent the springs from violently rebounding, thus preventing wear and tear on the car and adding to the comfort of the passengers.

GASOLINE TANK AND GAGE FOR SAME.—J. BORYSZEWSKI, JR., Box 178, Forks, N. Y. This invention relates to a liquid tank particularly suitable for gasoline used in automobiles, and a gage for indicating the amount of liquid therein



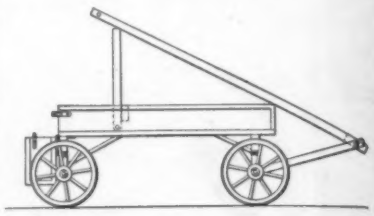
LONGITUDINAL SECTION, SHOWING INVENTION

An object is to provide an inexpensive tank which will maintain the smallest quantity of gasoline in the lowest part of the tank no matter how the automobile carrying the tank is positioned.

SIGNAL.—W. F. EGELHOFER, 348 Eastern Parkway, Brooklyn, N. Y. The invention relates to signaling devices for automobiles, the object being to provide an arrangement whereby when the steering device is moved beyond a predetermined extent a signal will be sounded, the signal may be sounded at any time manually or may be sounded automatically upon turning the steering mechanism beyond a certain point.

DIRECTION INDICATING SIGNAL FOR AUTOMOBILE.—C. J. BAKER, R. R. No. 6, Elkhart, Ind. This invention relates to an indicating system adapted to automobiles or other vehicles, for indicating the direction in which the vehicle is to be turned. The general object of the invention is to provide a device capable of being readily installed on any type of vehicle, it is so designed that the operation of the switches on the steering post or adjacent thereto will independently light lamps which have certain legends, indicating the direction in which the car is to turn.

CART.—J. J. BURTSCHER, Devil's Lake, N. D. This invention relates to children's carts, and has reference more particularly to a push-cart which has a hinged section which may be used as a step



SIDE ELEVATION SHOWING REAR SECTION IN POSITION FOR USE AS A STEP

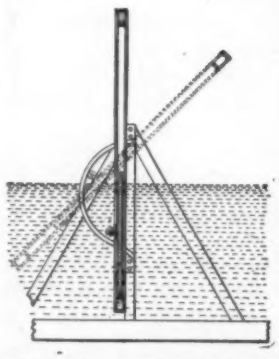
in the rear of the cart to facilitate the propulsion of same by a child. An object is to provide an inexpensive and strong cart which can be easily transformed into push-cart.

SHOE FOR AUTOMOBILE TIRES.—J. H. HEFFERNAN, address J. F. Simon, 196 Morton Ave., Albany, N. Y. The object of the invention is to provide detachable shoes for automobile tires which may be disposed around double tires, the shoes being connected together by links normally disposed in the space between the double tires, the said links carrying members for engaging the steel rim of the wheel between the tires to prevent the rotation of the rim relatively to the shoe.

PNEUMATIC WHEEL TIRE OVERSHOE.—S. WIESENBERG and S. LUSTIG, 341 Crimmins Ave., Bronx, N. Y. Among the principal objects which the invention has in view are, to provide a wearing surface for pneumatic tires, to prevent side slipping or skidding, to avoid damage to the tires, and to simplify the construction. The overshoe comprises a flexible cover for a tire and a split metallic band, means for maintaining same in service relation.

MOTOR STARTER.—H. P. E. PETERSEN, 280 4th St., Milwaukee, Wis. The invention relates particularly to a device for properly starting a kerosene motor. Another object is to provide a construction of cylinder head with a heating chamber and means for independently heating part of the heating chamber so as to produce a proper gasifying of the oil at the time and immediately previous to the time of ignition.

FLUID-DRIVEN MOTOR.—R. R. ROTHMAN, 2010 Broadway, Ave., Pittsburgh, Pa. The invention relates to fluid driven motors, operated by water current, by wave motion, or by air current. The invention is characterized by a blade arranged to slide back and forth in a revoluble frame from one end to the other, to alternately be positioned at the opposite ends of



TRANSVERSE VERTICAL SECTION OF THE DEVICE

the frame whereby to receive the full force of the current without liability of counteracting force being exerted by the current or wave at the opposite end of the frame. The arrangement is such that substantially the whole effective area of the blade is submerged when the blade is subject to actuating force

VEHICLE TIRE.—M. SAPO, 40 W. 28th St., New York, N. Y. This invention relates to tires of the resilient type, it is characterized by a tire having a rubber shoe inclosing individual springs presenting a V in side elevation, one branch of the V being connected with the other by a coil spring portions, and one of the branches preferably that which is anchored, has coil portions for increasing the resiliency of the spring.

CAR DOOR LOCK.—F. C. FRANK, Homestead, Ore. The invention relates to dumping cars or carts of the type in which the body is tiltable around a horizontal axis for dumping the contents by gravity. Among the special objects is to provide a substantially automatic means for locking the door closed and holding it in such position while the car body is held in normal carrying or transporting position, but being so designed that when the body is tilted the lock will be automatically released.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Shooting Orders

A rush order comes in at 5.28 p.m. The shipping order is written in thirty seconds, tucked into a Lamson carrier, slipped into a Lamson tube—Hoosh!—it reaches the shipping-room an eighth of a mile away one minute before closing time, and the shipment gets on the train just in the nick of time.

In this little incident you have the very ideal of modern business—the height of speed—absolute certainty. A messenger boy could have delivered the paper, but the train would have been gone. The telephone would have been quick, but it would have carried merely the oral message; the shipping form might have been forgotten, no record made of the order, and the billing overlooked.

Lamson Pneumatic Tubes

keep you in finger-tip touch with every department of the plant. When you phone "rush" instructions to some foreman, he may misunderstand or forget them.

The Lamson Tubes put the written paper with the instructions on them in his hand just as soon as the phone, but with absolute surety. Messenger boys sometimes loaf on the way, and sometimes lose papers; Lamson Tubes do neither.

What will they carry? They carry papers and small merchandise; they carry cash and documents in uncounted department stores; they daily carry millions of pieces of mail under miles of city streets; and they bring big shells out of the holds of war vessels to the gun turrets; they carry charges of powder through munition plants with ease.

The height of speed, absolute certainty—a Lamson Pneumatic Tube System works a miracle in speeding up and in *organizing* office and factory. The installations vary from a single tube to the hundreds of tubes found in big industrial plants, great hotels, banks, and insurance houses.

If you are troubled by slowness, by lack of order, by lack of certainty, by that business indigestion which comes with rapid growth, at least make a note here and now to let a Lamson representative call and discuss the advisability of Pneumatic Tubes for putting the height of speed and absolute certainty into your business. Or

Write for "Conveying by Tubes" and learn how your business can profit by Lamson Conveyors

THE LAMSON COMPANY, 100 Boylston Street, Boston, Massachusetts

Lamson Conveyors

Are We Building Real Ships?

(Concluded from page 151)

fleet ready inside 10 years after the Allies had been sunk to the bottom of the seas by the German submarines. Standardizing has saved the day. The race is now between the American workman and the German submarine. Without ships—men, airplanes, food, munitions are of no avail. Ships are the bridge to victory and the key to freedom from military tyranny. And it all rests with the American workman. The Government recognizes the fact by exempting from the firing line men engaged in shipbuilding. Whether the American workman recognizes the fact remains to be seen.

If shipbuilding is really going ahead at this war-speed pace, why the pervading and all-prevailing doubts that all is not well with us? Why such delays as 1,000 car-loads of material held back from one yard? Why the loud bickering, the constant change in personnel of the Shipping Board?

The answer to these questions in the broad is—first, you can't revive a dead industry in the shake of a stick; second, we ought to have begun three years ago, not eight months ago; third, and this is a point the politicians shy from as the plague, there have been 3,600 strikes in war industries in six months; and though the longest did not last three months, three months are more than a third out of eight months. Shipbuilding today is not just a shipyard proposition. It touches the lumber-jack, the copper miner, the steel factory, the engine manufacturer, the bridge builder, the oil driller, the lake sailor who brings down the raw ore for the steel mill, the coal miner, who supplies the fuel for the steel mill, the railroad hand who carries the coal and the steel from the factory to the shipyard. Three months ago, Newark Meadows was a salt swamp. Today, 28 miles of rail trackage convey material to one yard and 30,000 Texas logs have been driven in as piles, and 28 shipways have been built, which will turn off one ship every three days after the commandeered material comes to hand. Three months ago, Hog Island near Philadelphia was a 1,000-acre tract of marsh. Today, 20 shipways are built and barracks are being rushed up to house 30,000 men.

Also, it is most unfortunate that the Emergency Fleet's entire program has been involved in noisy useless controversies. I am going to tell the inside story of one of these controversies. When the cost of living began to soar so that one more jack-up threatened to lift Uncle Sam off his feet by a bayonet thrust through his stomach, it became apparent that some of the essential food industries paying dividends of twenty to forty-eight per cent on watered stock, might suffer a little paring of their profits without being absolutely driven out of business; and two or three Federal investigations were pending. The big men on the Emergency Fleet Shipping Board were asked to use their influence to head off the investigations. They refused. At once, a camouflage gunfire opened withering blasts against the Shipping Board. Some food profiteers were evidently trying to get away with their own swag under cover of gunfire against the Emergency Fleet. There is more than a suspicion that many of the press attacks and many of the threatened strikes were paid enemy propaganda. For instance, on a certain date in January, the Federal Secret Service notified all the yards on the Atlantic Coast of secret plots to burn one or all of the plants. The night of the plot, we know what was attempted at Newark. A little inside story of Philadelphia yards! That night in one of the biggest yards, all the plugs of the fire extinguishers were found to have been ruined; and when 'phone call was sent in for extra guards, not a response could be got.

All these doubts and attacks have been as cunningly inspired against the Emergency Fleet as the German camouflage that defeated Italy by sending Italian papers printed in Germany to the Army on the front with announcement of peace.

As to delays, does any sane person need to ask *why?*

Sites far out from crowded centers had to be found for the new yards.

These sites had to be drained and dredged and filled and the harbors deepened.

Piles in tens of thousands of car-loads had to be brought from Texas and the Pacific Coast.

Prices had to be set for the fabricating factories.

In the case of lumber from the Pacific Coast, timber cruisers from the mills nad to go out and find the timbers of the perfect size; and water flumes had to be built to float the huge timbers down to the mills; and new machinery had to be installed in the mills to cut the timbers in the new sizes.

And all the while, the I. W. W. were working their deadly, damnable German peace propaganda among copper miners, lumber-jacks, mill hands, longshoremen and truck men.

The wonder is not—so much delay. The wonder is so little.

If victory depends on ships, and ships depend on labor, and the race is now between the American workman and the German Kaiser, is there adequate labor? We shall need 500,000 men in the shipyards by spring. Shall we find them? Without a doubt. The yards now have 2,000 applicants a day by mail and another 2,000 in person. The question is not labor. The question is houses for the laborers; for the new yards are of necessity miles out from older congested centers. The Government is now advancing the money to the yards to finance the building of permanent shipyard cities—cement and concrete houses with all modern improvements, churches, theaters, moving pictures, hotels, hospitals; and money could not be more wisely spent. Men and their families will be anchored down to the permanent upbuilding of a great industry, that will long outlast the War.

But how about unskilled labor for the most highly specialized industry in the world? Granted that the magnet of high wages—$4.50 a day is the minimum, $6 the average and $90 a week not unusual—draws an abundance of labor, how is it to be trained for this new industry? The Government is attending to that, too. Modern shipbuilding is really bridge and steel work made to float. This class of workers is being sent to the old navy yards for terms of three months under pay of $4 to $6 a day to learn to become foremen in the new merchant marine yards. In return, they must bind themselves to stay with the yards which paid the cost of their tuition. The learners today will become the Schwabs and Fords of tomorrow; for the Emergency Fleet program is laying the foundations for an industry that will long outlast the War and give American commerce a dominant place on the seas of the whole world.

Bedding "Wool" made out of Cork

THE British Department of Overseas Trade has been informed through a reliable channel that a Spanish firm is manufacturing "wool" from cork which, it is claimed, may with advantage be substituted for natural wool in the manufacture of mattresses, pillows, quilts, etc. This material is stated to be cleaner and lighter than wool. Delivery is made in bales of 30 kilos (66 pounds), the packing for each bale weighing about 2 kilos (4.4 pounds), and the price asked is 2.50 pesetas per kilo (roughly, 25 cents a pound), on wagons, free of charge for packing but counting the gross for net weight.

In this connection the Department of Overseas Trade has also received from the same source information relative to a Spanish process for utilizing cork as a textile material. The cork is employed in the form of very fine pellicles, of which 14 go to make the thickness of a millimeter (0.03937 inch). It is first treated with chemicals to remove any resinous substances and to render it flexible and less likely to break. The cork is then sewn between two cotton sheets and pressed several times.

Improved Method of Sterilizing Liquids

AN improved method of sterilizing liquids by means of heat without employing a temperature high enough to cause marked alteration was invented some two years ago by a French scientist, Mr. Henri Stassano. After extended experiment Mr. Stassano has recently laid before the French Academy of Sciences convincing proof of the superiority of his process to the ordinary method of heating the liquid to be sterilized in a closed vessel. The process is particularly valuable for sterilizing milk and for preparing microbic cultures.

Its essential principle consists in the application of the heat to an extremely thin layer of the liquid—a layer one one hundredth of a millimeter thick, *i. e.*, having a depth of about ten bacteria lengths, for a very brief period of time. The liquid is made to traverse the heating apparatus under the uniform pressure of a compressed inert gas, nitrogen.

The heating apparatus is very simple though novel in construction. It consists of two thick bronze plates of suitable size held together by numerous screws at a uniform distance. These plates are rectangular and must be absolutely plane of surface and precisely superposable. The necessary distance between them is obtained in an ingenious manner. A hollow square, or "picture frame," is cut out of a piece of Japan paper only 1/100 of a millimeter thick. The outer perimeter of this frame corresponds to that of the bronze plates. This paper frame is inserted between the two plates, which are then screwed firmly together so as to form a water-tight receptacle whose interior is delimited by the interior perimeter of the frame. One of the plates is pierced at either end by a row of tiny holes, by means of which the circulation of the liquid to be sterilized is established, the apparatus being heated in a water-bath to the required temperature.

The advantages over the usual sterilization methods are marked. First, the liquid is brought to the desired temperature with the greatest possible regularity and rapidity, whereas in the ordinary closed vessel, heated either over a water-bath or by an autoclave, thermic equilibrium in the interior of the liquid is established very slowly, the more so the larger the quantity of the liquid.

Secondly, there is a corresponding ease in cooling the liquid as soon as it has attained the temperature required, by passing it directly from the heating apparatus into a refrigerating device. The injurious effect of the heat is thus arrested instantly, as soon as the objective purpose has been achieved.

Thirdly, a very large volume of liquid can be treated expeditiously and continuously, whereas the quantity operated on in a closed vessel is limited by the dimensions of the water-bath or the autoclave. The laboratory apparatus employed by Dr. Stassano, though of very modest dimensions, 27 centimeters long by 17 centimeters wide, (about 10.5 inches by 6.6 inches), enabled him to sterilize with ease more than one hundred liters of physiologic solution per hour, and from thirty to forty liters of bacterial emulsions, without exceeding a pressure of two kilograms, and without raising the temperature unduly.

On comparing the results obtained by this method with that of the closed vessel it became very evident that the duration of the heat, rather than its intensity, is the principal factor in the alterations occasioned by heat in living organisms and their organic environment of albuminous nature. The degree of the temperature, within certain limits, of course, played but a secondary part.

Dr. Stassano cites several interesting examples in proof of this contention, the one of greatest general interest being that of the sterilization, a matter of peculiar importance at the present moment. Thus, cow's milk, sterilized by this process at 126 to 128 degrees Centigrade (258.8 to 262.4 Fahrenheit), had neither the color nor the taste characteristic of milk sterilized in the bottle in the autoclave at a temperature of less than 115 degrees C. (239 degrees F.). Even when brought to a still higher temperature, 135 degrees C. (275 degrees F.), the milk sterilized in thin layers exhibited much less alteration by the heat coupled with pressure than milk simply brought to the boiling point in the ordinary manner, for several minutes. Moreover, this milk, which betrayed the treatment to which it had been subjected neither in taste nor in color, was found, on the addition of lab-ferment, to curdle almost as rapidly and quite as satisfactorily as fresh milk. The same milk, heated for 15 minutes in the water-bath at 100 degrees C. (212 degrees F.), coagulated much more tardily, the curd exhibiting striae as well as precipitates and extending copious serums of a greenish tint.

Other characteristic results obtained by this apparatus, of special interest to bacteriologists are given. Thus a one per cent emulsion of egg albumen in physiologic solution, heated in a water-bath to 58 degrees C. (136.4 degrees F.), within a glass bulb (boule sealed in the flame, under a volume of 300 cubic centimeters (cm3), becomes opalescent at the end of two hours. This emulsion keeps its limpidity, on the contrary, when carried to 75 degrees C. (167 degrees F.), for a fraction of a second.

Again, one liter of the toxin of tetanus heated in the water-bath for one hour at 55 degrees C (131 degrees F.), loses all its power, even with respect to those most highly sensitive animals, the horse and the mouse. This same toxin in Dr. Stassano's apparatus, heated to 80 degrees C. (176 degrees F.), still retained a portion of its activity. A mouse into which was injected 0.5 cubic centimeters of a toxin of which 1/5000 ordinarily kills, did not die, but remained seriously paralyzed for more than three weeks. Heated only to 56.5 degrees C. and to 60.5 degrees C. (133.7 degrees F. and 140.9 degrees F.), the results were even more favorable. The antitetanic serum of the horse, heated in a thin layer to 67 degrees C. (152.6 F.), for a fraction of a second, behaves exactly like a non-heated specimen of the same serum. Heated in a water-bath to a much lower temperature, 56 degrees C. (132.8 F.), but during one hour and 15 minutes, this same serum exhibits a slight loss of strength.

Special Water Supply Department for the French Army

WITHIN a recent period, the French army has undertaken the organization of the water supply on a very efficient basis. This is made necessary by the present circumstances, says *Le Matin*, for in fact there is a great accumulation of men and horses in certain regions of the fighting line in which there is only a sparse population. Then we also have the extensive army transports consisting of ammunition and supplies upon old or new railroads, requiring a large amount of water for the locomotives. In view of the extensive water supply which is needed for all these purposes, it became necessary to organize an efficient department for this work, and especially to provide for a sufficient supply during dry seasons.

One part of the work consisted in securing a supply from springs and properly fitting these up, either to obtain the water or to prevent contamination. Wells were also cleaned out, disinfected and provided with pumping plant, and new wells were driven in many cases down to 500 feet. Again, in special cases where an especially large supply was to be obtained, this led to the construction of veritable waterworks with pumping machines on a large scale and pipe lines of several miles length. For instance, at four or five points there are now plants which elevate as much as 25,000 cubic feet per day and distribute it in the camps as well as to watering tanks for the cavalry and reservoirs used for supply of steam engines.

In the army zone, the water supply is organized on standard methods. For the troops, the layouts existing in the villages are improved and extended. Reservoirs and hydrants are erected near hospitals and barracks or camps, and tank stations are spaced along the roads for use for the traveling kitchens and motor tank wagons.

These latter will hold 1,000 gallons and their function is to bring this water as near as possible to the fighting line where they deliver it into tanks, whence it is moved in kegs or skins into the trenches themselves. As regards the horses, when these are few in number they can be watered in ponds and rivers, but where several thousand horses are assembled at the camps, it becomes impossible to use the rivers, for these soon become muddy and polluted, and the banks are in very bad condition. But now the horses are watered on a more modern method, using a great number of watering tanks supplied by engine-driven pumps which take water from streams, wells or springs. Carrying out the special organization of all this work, each army now has a superior officer appointed for the purpose who commands a squad of specialists for work upon wells, or for boring the same, plumbers and the like, the total number for the French army being 3,500 men and 75 officers. Since it began operations, this water supply department has carried out very extensive work and at numerous points. It fitted out 3,800 existing wells and sunk 2,000 new wells. The total amount of piping laid by the working force amounts to 200 miles.

But in spite of all the precautions which are taken to protect the outlying ground around these sources of supply, it is impossible to count upon an absolutely pure water, and therefore it was decided as a general measure to sterilize the drinking water, either by boiling, when this could be done, or by the use of filters, but the most frequent process is a chemical treatment by the addition of hypochlorite of soda, chlorine water or iodine. But chlorine water is found to be much the best, as it is simple, cheap and reliable. This process is not a new one, and before the war it was used in Paris, Marseilles and other cities in France. Since the war it has been adopted for city water supply in the army zone where the water was of a doubtful quality such as Compiègne, Verdun, Lunéville and others. The same process is used for the filter wagons and filter boats now employed in the army, and these are equipped with filters which intended to prepare the water for the troops, and the filtered water is treated with "Eau de Javel" or chlorine water. Each army has its special laboratory, under the sanitary department, to test any water and pronounce it potable or not, and for these tests the laboratory is equipped for bacterial researches. Each army corps also has its smaller laboratories for chemical and toxicological analysis of water. It will thus be seen that the water supply department in the French army has been organized on a very effective scale with a few officers and men, and not only does it afford all the water required to the troops, but it prevents epidemics in large assemblages of troops or population which would be most dangerous at the present time.

Tagging Fighting Men for Identification Purposes

(*Concluded from page 149*)

At the beginning of the war Tommy only had a single tag; and because of the shortage in aluminum, many of them wore tags of cardboard. But beginning November, 1916, the British army provided a new model consisting of two tags, one octagonal and red and the other round and green and suspended from the first. In the case of a fallen man the green tag is removed while the red one is left for the future identification of the remains.

The Belgians even in peace times were provided with identification tags of the type shown; but in 1915 they adopted the French model, fastened to the wrist by a chain bracelet.

Italy entered the war with the firm belief that it would be one of short duration. So each Italian soldier was provided with a metal identification plate sewed on the inside of his tunic. But with the war drawn out and with uniforms wearing out the Italian government was forced to adopt another form of identification tag, which it did in November, 1915. The present Italian tag consists of a rather elaborate book-like locket, containing a folded paper record, suspended on a string about the neck. This record is rather complete compared to others; for it gives the name in full, military class, recruiting district, names of parents or relatives, residence of immediate family, regiment, various vaccination records and wounds. The Italian locket is rather bulky; for this reason many prefer to wear it on a chain and in the pocket, after the fashion of a watch.

The Serbians entered the war with a tag similar to the first Italian model, but since have replaced it with the French tag.

Because their losses have been so heavy, there is all the more reason why the Russians should have had some form of identification tag. But with the single exception of the Russians fighting in France, no identification tag was provided. Hundreds of thousands of fallen Russians, it is safe to say, were never identified and to this day their families do not know what became of them. Untold misery and anxiety and countless legal tangles must have been the portion of Russia for lack of those inexpensive tags.

As already stated, the Germans entered the war with the tag of the same type as that of 1870. This tag only carried the numbers of the army corp, the regiment, the company and the draft. It was worn on a string passing around the neck, and in some cases was placed in a leather pouch. In June, 1915, this model was replaced by a more complete tag, oval in form and of much larger dimensions. This new tag carried the names, residence, date of birth, mobilization data, and a number of more or less confusing numerals and letters.

In November, 1916, the German army adopted still another model, larger than the preceding one, but made in the split form as shown. The two halves, one the duplicate of the other, are separated by a scored line which facilitates detaching one-half while the other half remains on the body of the fallen soldier.

The Austrians make use of a locket similar to that of the Italians, which is also worn on a string passing about the neck. The Turks employ a round tag of metal carrying the name, first name and the regimental number.

After having made a careful study of all the identification tags used in the past and the present, Dr. Bosredon of France has devised an ingenious split tag which has lately been distributed to French troops for trial. As will be noted in the illustration, this tag, like that of the Germans, is made in duplicate, so that it can be broken on the scored line and one half left with the remains while the other half is forwarded to the proper authorities for checking purposes. The tag is worn on the wrist by means of a simple but ingenious chain bracelet.

Our Navy is making use of a tag which is unique among all identification tags for the reason that it carries the thumb print of the bearer. The tag is made of monel metal and is unaffected by the corrosive action of sea water. It is quite small, measuring in oval shape 1¼ by 1½ inches. It is perforated at one end so that it can be suspended from the neck by a wire braid, which in turn is encased in a cotton covering. One on side appears the name and initials of the wearer, the month, day and year of enlistment and month, day and year of birth. "U. S. N." is added, and when the owner is an officer, his rank and date of appointment. On the reverse side is the finger print.

Coal Production of Serbian Mines

ACCORDING to the *Deutsche Balkan Zeitung* of Sofia, an expert who has been looking over the Serbian coal fields to find opportunities for investment, declares that hard and soft coal and lignite are found in great abundance in Serbia, offering excellent opportunities to capital. While it has long been known that Serbia was rich in coal lands, there were but 14 mines operating in the year 1910. The number had increased in 1914 to 22, but because of lack of miners, machinery, enterprise, and capital no further development seems to have taken place. The expert referred to in the *Zeitung* found 10 more localities in which mines could be

successfully operated, besides a rich field of coal near Usce, along the bed of the river Iber.

Statistics show that the product of the soft coal and lignite in Serbia doubled between 1900 and 1910, 51,320 tons of anthracite coal, 16,622 tons of soft coal, and 7,899 tons of lignite having been mined in the latter year.

Since the occupation of Serbia, all its mines have been in the hands of German army engineers who have so thoroughly organized the work upon them that it is generally believed the output has been increased considerably.

Standardizing Paints and Containers in War-Time

THE Council of National Defense makes the following announcement:

To conserve tin and linseed oil and other ingredients of paint that are necessary for carrying on the war, paint manufacturers now making in some cases as high as 100 shades of house paint, will limit themselves after July 1st to 32 shades. They will also eliminate several sizes of containers. Recommendations to this effect have just been issued by the Commercial Economy Board of the Council of National Defense. The board consulted with practically all manufacturers and representative dealers in preparing the recommendations and is already assured of the coöperation of practically the entire trade.

The detailed limitations refer to all kinds of paint and varnish. Enamels, for instance, will be restricted by the manufacturers to eight shades, floor paint to eight, roof and barn paint to two, shingle stains to 12, oil colors to 30, carriage paint to 8, architectural varnishes to ten grades, marine varnishes to four, and so on. In many cases this will mean a reduction of 50 per cent or more.

Half-gallon cans are to be discontinued altogether for both paints and varnishes, as are also all cans smaller than half-pints. In several kinds of paints, pint containers are to be eliminated and all cans smaller than gallons in barn and roof paint, and shingle stain are to be dropped. The reductions are expected to involve little inconvenience to consumers.

The Current Supplement

ALTHOUGH ship forms have been studied for ages, and elaborate and ingenious apparatus has been devised to assist in the investigations, there is still much to be learned; and this is partly due to the intricacy of the problems involved, but also to the constantly changing of conditions, both of the service required and of the propelling machinery. An article on *The Propulsion of Ships* in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2198 for February 16th, calls attention to the matter and points out some of the immediate necessities. We have heard much of the prehistoric men of Europe; but there were also cave dwellers in America in very ancient times. The article on *Cave Dwellers of the Missouri Valley* tells us something of one of these old races, and it is illustrated by photographs of remains that have been found, and reproductions founded upon them. *Gasoline's Part in the Great War* throws an interesting light on one of the most important problems of the operations in Europe. Preventive treatment in disease has had a wonderful development and application on the battle fronts in Europe. An article entitled *Making Anti-Toxins for the Great War* describes a modern establishment in Canada for the production of certain preparations employed extensively, and is illustrated by a number of photographs. *The Causes of Disease* is an attempt at classification with a view to prevention. The description of the remarkable *Compound Harmonic Motion Machine* is concluded in this issue, and is accompanied by a great number of typical curves. *Restoration of Materials After Fires* tells of modern methods of salving by which great loss is avoided. Other articles include *Theories and Problems Relating to Musical Sands; Sources of Potash* and *The Hardening of Steel by Chromium and Copper*.

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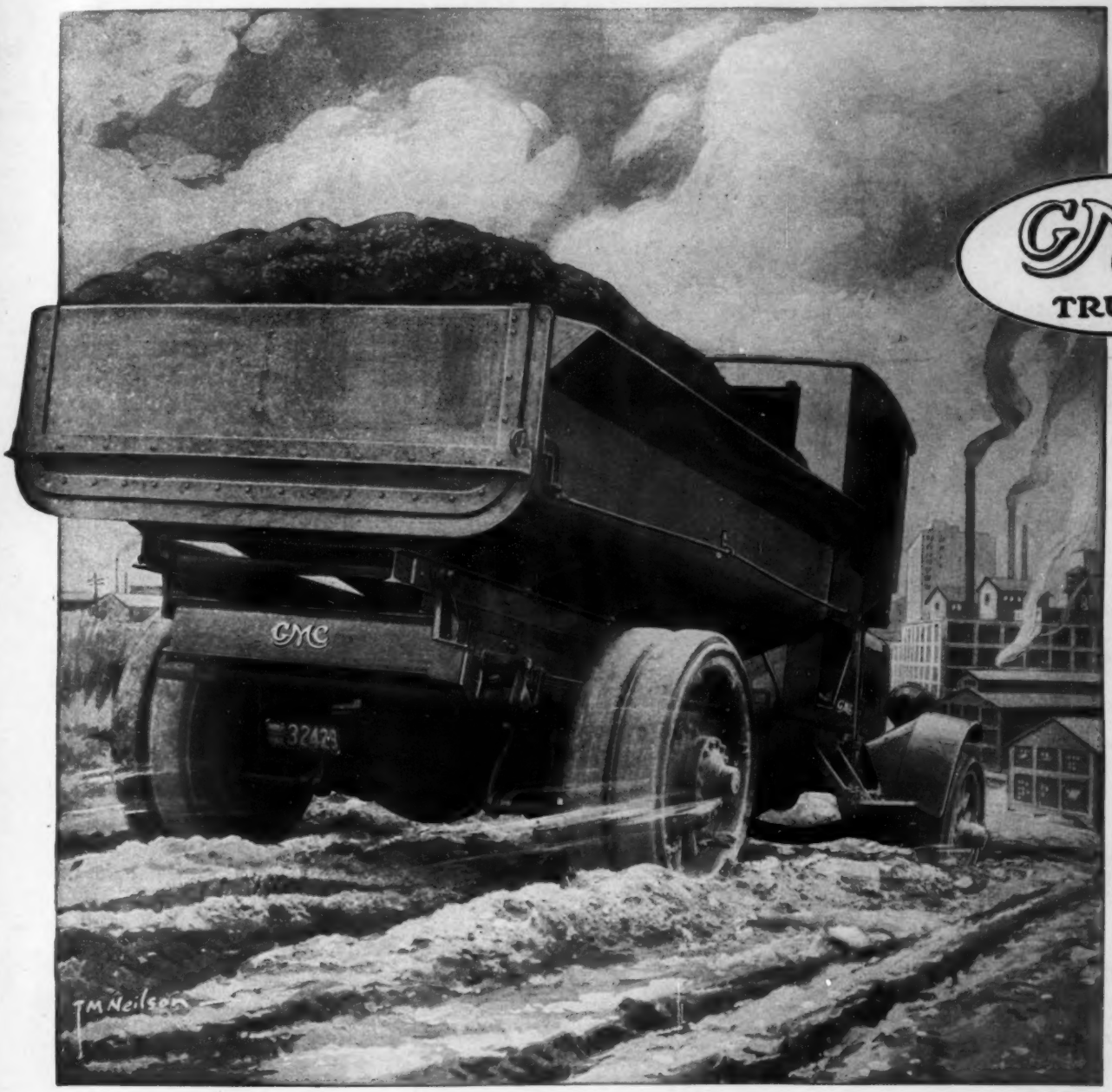

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"Road-ability" sums up in a single word the character of GMC Performance. Behind Road-ability is that staunchness guaranteed by GMC Overstrength and Oversize at every point.

Every now and then an example of unusual GMC Road-ability comes to notice. Here is a case in point:

Although January 12, 1918 was the date of the worst blizzard and the coldest day in the history of the Detroit weather bureau—16 degrees below zero—, with snow drifted yards deep, a GMC Truck kept the road all day.

This five-ton truck hauled coal to keep an industrial plant from closing down, although the 60-mile blizzard demoralized street car service and prevented express companies and mercantile concerns from attempting delivery.

All day this GMC hauled coal from a snow-bound siding over a nine-mile route, six tons at a load, and made five round trips. For eighteen hours the following day it made eight round trips, hauling 48 tons, from seven in the morning until midnight.

No matter what your truck requirements, there is a GMC to meet your needs as this one met the needs of its owner. Through winter snow or spring mud GMC Road-ability can be depended on. There are six practical sizes.

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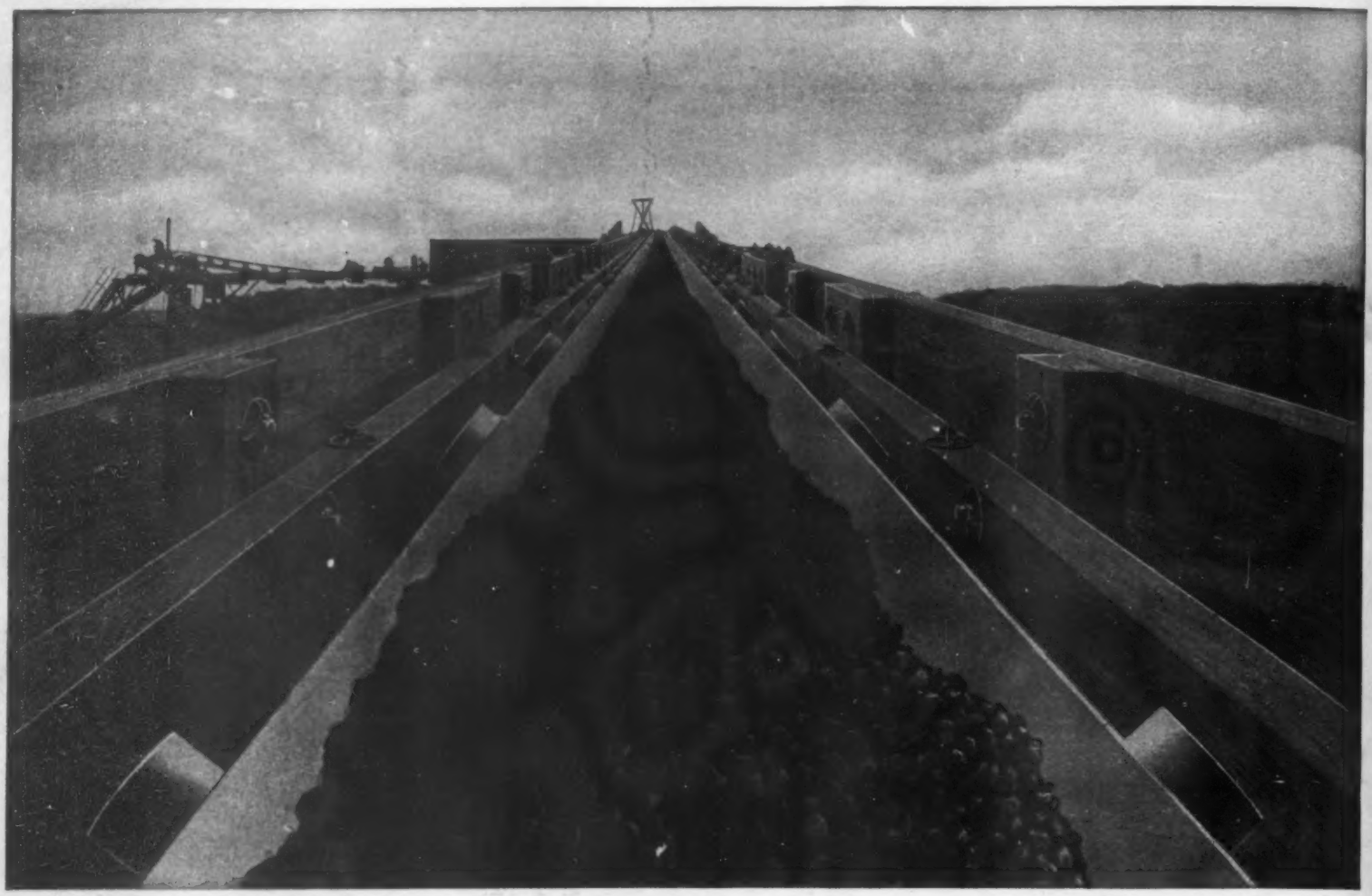

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With coal as big a factor as gunpowder in winning the war, national necessity requires quick handling of the products of mines at the source, at the receiving points and at distributing centers.

This is not the time for "slackers"—human or mechanical. Nor is it the time to put anything but the best of materials or workmanship into equipment to serve the urgent needs of the country. Nor is it the time to quibble over price at the sacrifice of efficiency.

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On a cost-per-ton basis, Q. C. R. Co. Belts have won out in some of the biggest coal mines, ore mines and mills and storage and shipping plants in the United States and other countries.

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No class of goods is of so varying quality—unless the greatest care is exercised—as articles made wholly, or in part, of rubber. To secure the utmost utility from the peculiar properties of rubber, and to secure positive uniformity of quality is the standard sought from the laboratory where the crude materials are tested, through every stage of manufacture, and again in the laboratory where chemical and physical tests of all finished goods are made.

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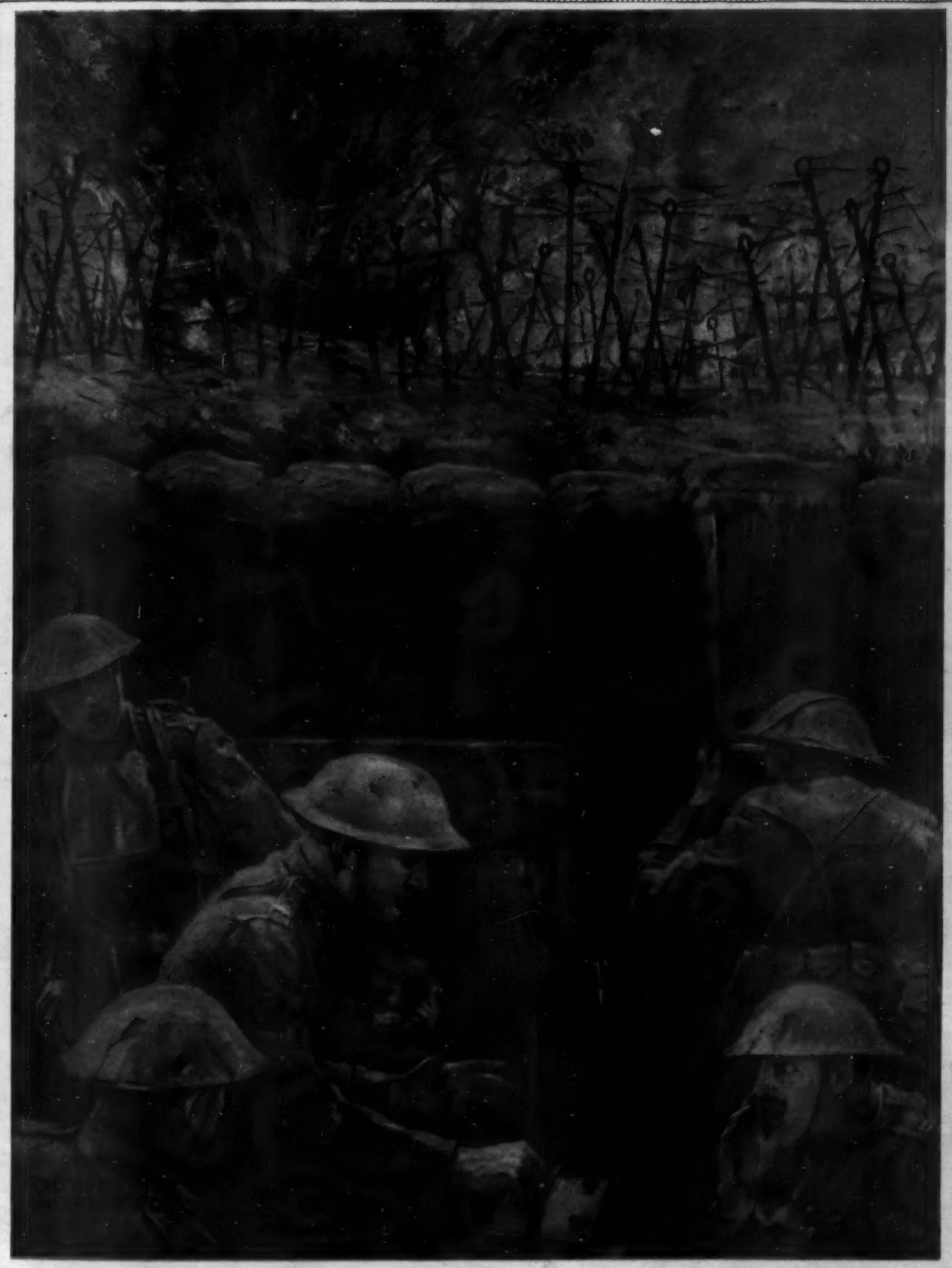

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